MARCH

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION AND THE DENTAL COSMOS

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Local Anesthetics—*Tainter et al.*
Amalgam—*Hollenback*
Drugs—Their Use and Abuse—*Gurley*
Denture Prosthesis—*House*
Is Caries Endocrine Problem?—*Hogeboom*
Management of Involved Pulps—*Davis*
Cooperation in Antrum Cases—*Straub*
Acute Oral Infections—*Frew*
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"Pyorrhea Cannot Be Cured"
Anti-Syphilis Crusade

COUNCIL ON DENTAL THERAPEUTICS
Accepted Dental Remedies

BUREAU OF PUBLIC RELATIONS
Dental Changes in Indian Children—*Arnim et al.*

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President of the American Academy of Periodontology

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and THE DENTAL COSMOS

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Original Communications

DENTAL ARTICULATION AS AN ORTHODONTIC AIM*

By HARVEY STALLARD, D.D.S., San Diego, Calif.

IF articulation is to be accepted as the aim of orthodontic treatment, it will be necessary for us to know how the main factors in articulation are interrelated; how the height of the cusps, the slant of the condyle paths, the character of the condyle paths and the inclination of the plane of occlusion affect the curve of Spee; how the lateral rotation centers and the lateral paths of the condyles are related to the position of the teeth in the arches and to the overjet of the teeth, and how the opposing ridges of the teeth are related in all the articulative movements and in the various stations of these movements.

THE GNATHOKIN

In order to gain usable knowledge of the interrelation of some of these factors of articulation, I made use of an instrument designed by B. B. McCollum, of Los Angeles, and Charles E. Stuart, of Ventura, Calif., which I have called the gnathokin. (Figs. 1-2.) The instrument consists of a mandibular and maxillary portion connected by a condyle device in the upper left corner. Slotted bars, corresponding to the alveolar processes, are attached to the jaws of the gnathokin by slotted metal strips fastened securely by set screws. The conventionalized roots of the teeth are each provided with a slot through which a set screw passes, by means of which each tooth can be rigidly fastened to the alveolar frame after the desired position of the tooth is obtained. The cusps of these metal teeth were made by pantographing their outlines from a photograph of the lateral view of the teeth of a young person with excellent articulation. The condyle is adjustable and graduated so that any desired slant can be obtained and recorded. The character of the condyle path can be altered by inserting different condyle disks, which may be made with any desired series of slots. The whole mechanism has

*Read before the Section on Orthodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

dimensions twice the gnathic and dental dimensions of the person selected.

RECORD MAKING

With this device, it is possible to articulate the teeth in any location of the intergnathic field or on any given slant of the occlusal plane. All records of the articulated teeth can be readily made by simply placing a sensitive photographic paper under the adjusted instrument, while in a dark room, exposing it to light and subsequently developing and fixing it. (Fig. 3 *A*.) These silhouettes are also

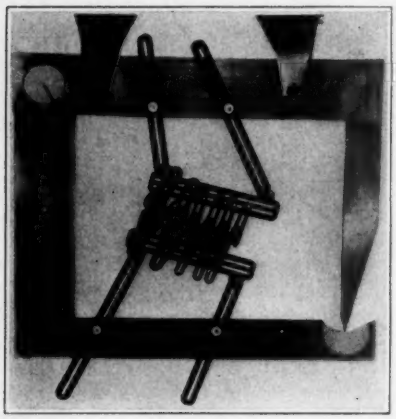

Fig. 1.—Gnathokin, with teeth in centric closure.

infallible evidence of how well the centric intercuspation and the protrusive articulation of the teeth were obtained. (Fig. 3 *A* and *B*.)

PREPARATION AND PRESERVATION OF RECORDS

The silhouettes coming from the drying tins furnish the following data: the slant of the condyle path, the position of the denture and the slant of the incisal guide (that portion of the mechanism in the lower right corner). The following lines are drawn on the print: The line representing the occlusal plane, the curve of Spee and a horizontal line used to determine the angle of the slant of the occlusal plane. The following illustrative designs and lines are drawn on the prints: The condyle disk and a horizontal line to indicate the angle of the slant of

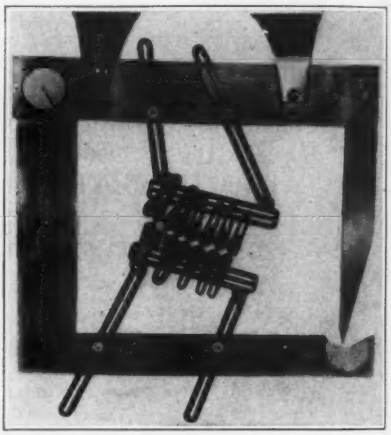

Fig. 2.—Gnathokin, with teeth in protrusive articulation.

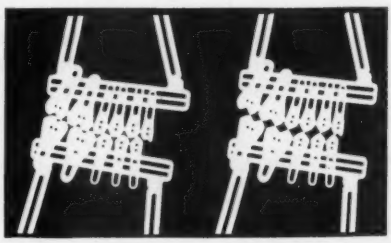

Fig. 3.—Silhouettes of gnathokin, in centric (left) and in protrusive (right) articulation.

the condyle path; the extension of the lines indicating the angle of the incisal guide, and the arcs by which the angles are measured. The lengths of the radii of the curves of Spee are printed in the upper right corner of each frame of the

right column. The line *OP* representing the occlusal plane is determined by drawing in white ink a straight line from the tip of the distal cusp of the second mandibular molar to the apex of the mandibular cuspid. In order to determine the angle of the slant of the plane of occlusion, a horizontal line *HORP* is drawn in white ink from in white ink. Since one print is necessary to record the centric closure and another to record the protrusivè articulation, and in order to keep the prints as simple as possible, the print of centric exposure is used to display the plane of occlusion, and the protrusive print, the curve of Spee. To prevent the added white and black ink marks and lines from being smeared

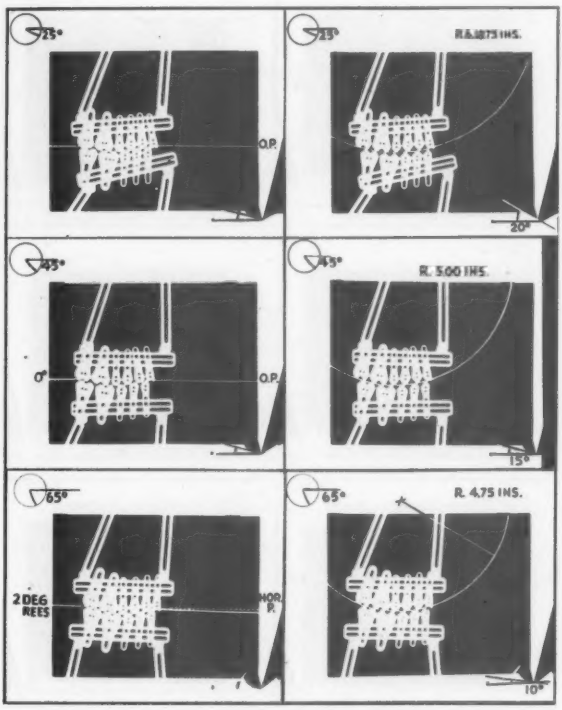

Fig. 4.—Silhouettes showing how, when plane of occlusion is kept horizontal, increasing slant of condyle path decreases radius of curve of Spee.

the point where the occlusal plane line intersects the edge of the mandibular ramus. The curve of Spee is determined by the geometric method of inscribing in a circumference three or more points, and it is then drawn on the print or erased by accidental rubbing, the prints are sprayed with a fixative varnish.

EFFECT OF CONDYLE SLANT ON THE CURVE OF SPEE

It has long been known that the slant

of the condyle path has a direct influence on the curve of Spee. To show this influence, I have selected those prints in which the plane of occlusion is kept constant, but in which the slant of the condyle path is changed. The slants of the condyle selected are 25, 45 and 65 degrees. Each change in slant of the condyle requires resetting the teeth. For the curved condyle path used, there are four groups of prints. In the first series (Fig. 4), the plane of occlusion is horizontal, and it will be noted that, as the slant of the condyle path is increased, the radius of the curve of Spee decreases. In the second series (Fig. 5), the occlusal plane is slanted 15 degrees in the three articulations and a similar change is noted in the radii as the condyle path is made steeper. In a third series (Fig. 6), in which the occlusal plane is maintained at 25 degrees, the radii of the curve of Spee decreased with an increased slant in the condyle groove. In Figure 7, the occlusal plane is slanted inordinately (at an angle of 50 degrees), yet the same general influence on the radii is noted as the slant of the condyle groove is in-

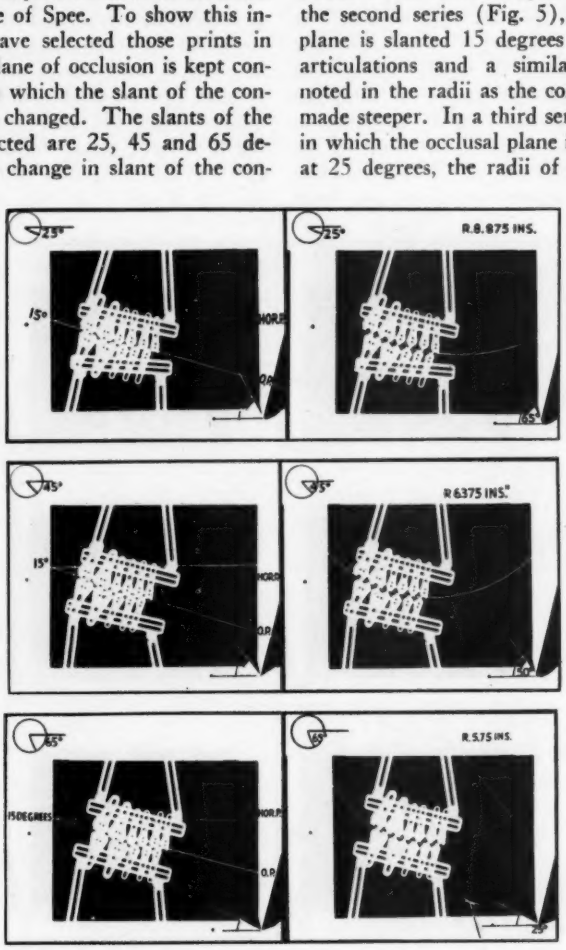

Fig. 5.—Silhouettes showing how, when plane of occlusion is slanted 15 degrees, increasing slant of condyle path decreases radius of curve of Spee.

creased. The same sort of experiments were carried out with a straight condyle path. The results are shown in Figures 8-11. All the radii of these series are longer than corresponding radii effected in the articulations of the curved condyle path, but it is again definitely demonstrated that, as the condyle path becomes steeper, other conditions being kept constant, the radii of the curve of Spee decreases.

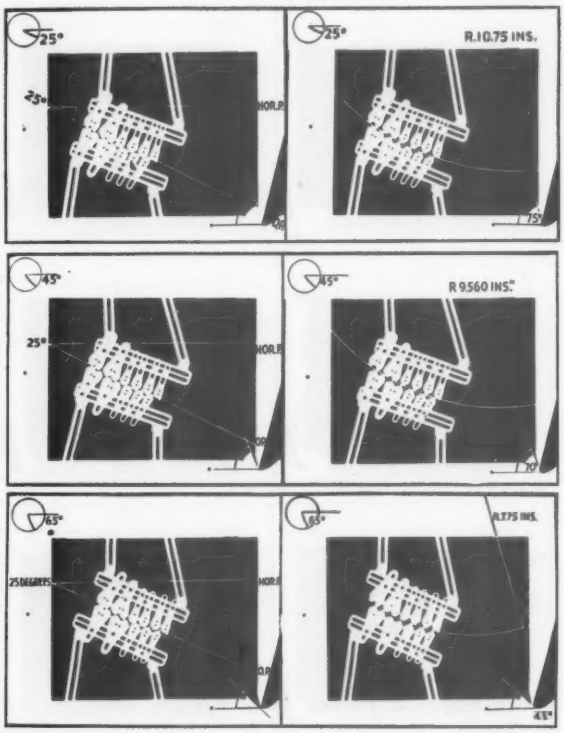

Fig. 6.—Silhouettes showing how, when occlusal plane slant is kept at 25 degrees, increasing slant of condyle path decreases radius of curve of Spee.

EFFECT OF THE SLANT OF THE OCCLUSAL PLANE

Hitherto, little has been said, or written, about the effect of the slant of the plane of occlusion on the character of articulation as indicated by the curve of Spee. The variations in the inclination of the plane of occlusion were first brought to my attention by a study of gnathostatics. Almost immediately after gnathostatics was introduced into this country by Simon, McCollum altered his articulator and facebow so that it would be possible to relate the mounted models to a plane in the face. The plane chosen was not the Frankfort, but one more definitely related to the function of the mouth. This plane McCollum deter-

mines by the hinge axis of the condyles and the infra-orbital points. Thus, in the gnathologic mountings of casts, variations in the slant of the plane of occlusion can be studied. The first demonstration of its importance to the character of articulation was made by Stuart, in 1934. After Stuart's demonstration, how the plane of occlusion has been progressively steepened. Those in the right column show the corresponding protrusive articulations of the centric set-ups of the left columns with the corresponding curves of Spee. It will be noted that, as the plane of occlusion is steepened, the radii of the curve of Spee is increased.

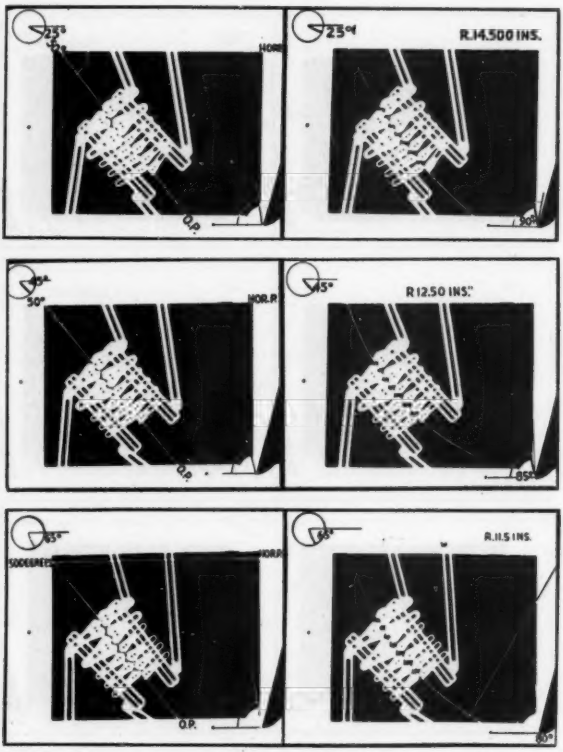

Fig. 7.—Silhouettes showing how, when occlusal plane is kept slanted at 50 degrees, increasing slant of condyle path decreases radius of curve of Spee.

McCollum substituted metal individual teeth for the united celluloid teeth used by Stuart and lent the instrument to me to work out the effect on the curve of Spee. In Figures 12-14, the arrangement of the prints shows in the left column This is true when the condyle is curved and its slot set at 25, 45 or 65 degrees. The same principle is again shown when the curved condyle path has been replaced by the straight path. (Figs. 15-17.)

EFFECT OF THE CHARACTER OF THE CONDYLE PATH

It has been made apparent in the foregoing illustrations that the character of the condyle path influences the curve of Spee, but to make clearer this fact, I have assembled in the next three illustrations (Figs. 18-20), all of the silhouettes of Figures 12-14, and the right-hand columns of Figs. 15-17. Thus, in Figure 18 there are three vertical columns of prints, the left and middle composed of Figure 12, but the right the right column of Figure 15. The reassembling of the prints in this grouping permits one to see at a glance how a change from a curved condyle to a straight condyle path requires an articulation on greater cuspal curvature. Hence, all of the radii of the right column of prints are, respectively, longer than those obtained in the articulations in the middle column, although the plane of occlusion in both set-ups was maintained at the same slant, the only change being in the character of the condyle.

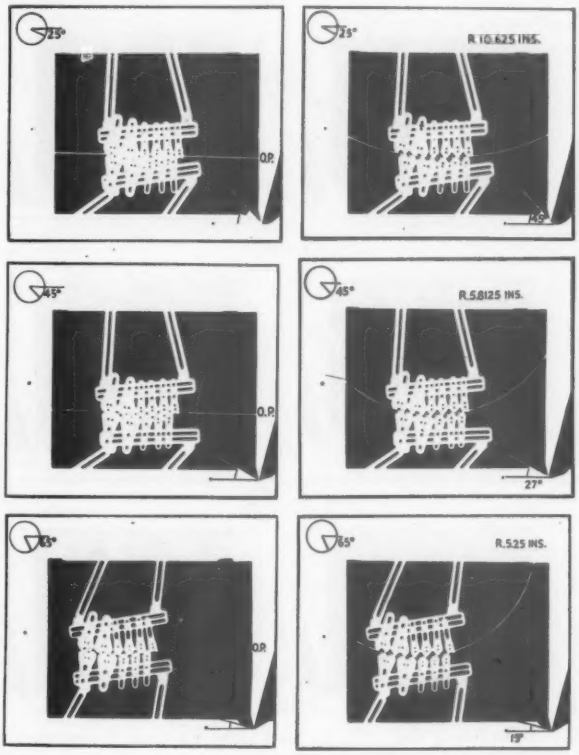

Fig. 8.—Silhouettes of gnathokin with straight condyle slot substituted for 4-inch curved slot of Figures 3-7 and occlusal plane kept horizontal. As the condyle path is steepened, the radius of the curve of Spee decreases.

EFFECT OF TOOTH POSITION IN GAINING ARTICULATION

In all the foregoing experiments, the articulation was obtained by extruding or intruding the teeth into articulation after the distal cusp of the lower second molar and the apex of the lower cuspid were placed on the selected line indicating the plane of occlusion. Of course, the position of the teeth must be changed to bring their cuspal surfaces into such occlusal relations as will permit maintenance of contact during the movement from protrusive articulation to centric closure. In other words, the cusps must be so arranged that during such a movement, while maintaining articulative contact, they cooperate with the slant of the condyle path.

TOOTH TOLERANCE TO CHANGED POSITIONS

The coronal parts of these metal teeth were conventionalized as little as possible, not at all intentionally, so that they represent a mesiodistal longisection of the natural teeth from which they were modeled. Their cusps are bounded by curved surfaces just as the natural teeth are. Natural teeth lack flat surfaces and

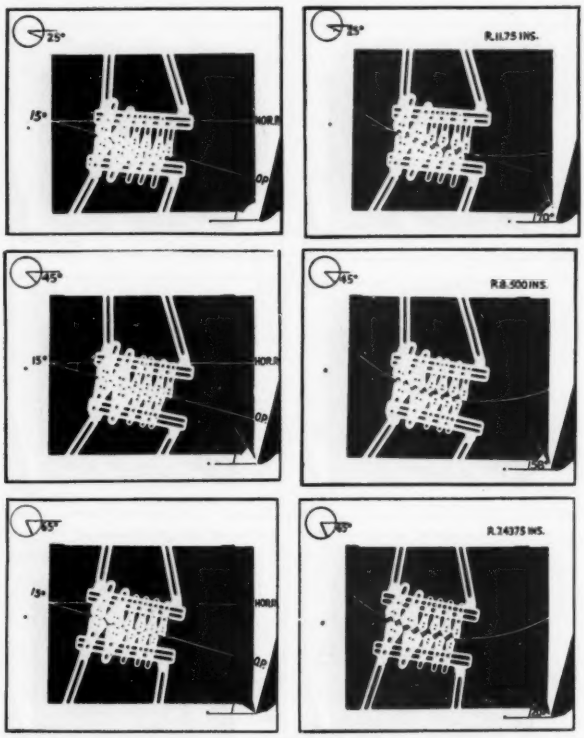

Fig. 9.—Silhouettes showing how, when occlusal plane is kept at 15 degrees, increasing slant of straight condyle slot decreases radius of curve of Spee.

plane angles. Their cusps are bounded also by spherical surfaces and their angles are formed by the intersection of these spherical surfaces. Consequently, the points of the cusps may articulate at different points of the curved surfaces bounding the grooves and fossae of their opponents. A study of these variations in the articulation in the previous figures will disclose that the cusp points in their various positions found different occlusal surfaces for contact. This adaptation to different occlusal contacts depends on the spherical surfaces and provides the tooth with an articulative tolerance to various positions in the face. If this work is indicative of things practical, it indicates that teeth can be articulated in almost any position in the mouth within keeping of the best dentolabial relations.

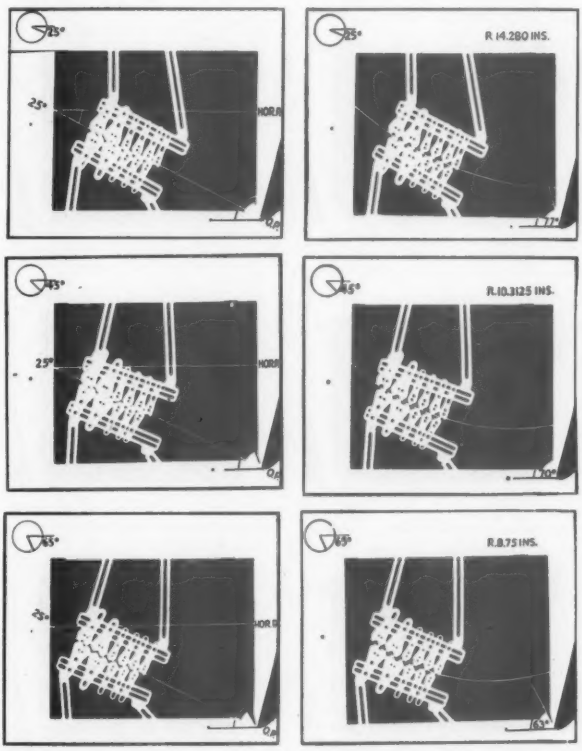

Fig. 10.—Silhouettes showing how, when occlusal plane is kept at 25-degree slant, increasing slant of straight condyle slot decreases radius of curve of Spee.

POSITION OF THE "SET-UP" IN THE INTERGNATHIC FIELD

In order to facilitate experimentation and simplify the procedure, the teeth were articulated on a given slanted plane of occlusion, and then the articulated assemblage of the teeth was moved about

in the intergnathic field, up and down, forward and backward, the same slant of the plane of occlusion always being maintained, in reference to the lower edge of the upper arm of the gnathokin. Each location of the assemblage was tested for articulation and recorded in row, it was placed in midfield, and, in the lower pair of prints, in the upper central position. The articulation is the same in all three. In Figure 22, in the upper row of silhouettes, the assemblage is the same as in Figure 21, but, in the upper right print, the plane of occlusion

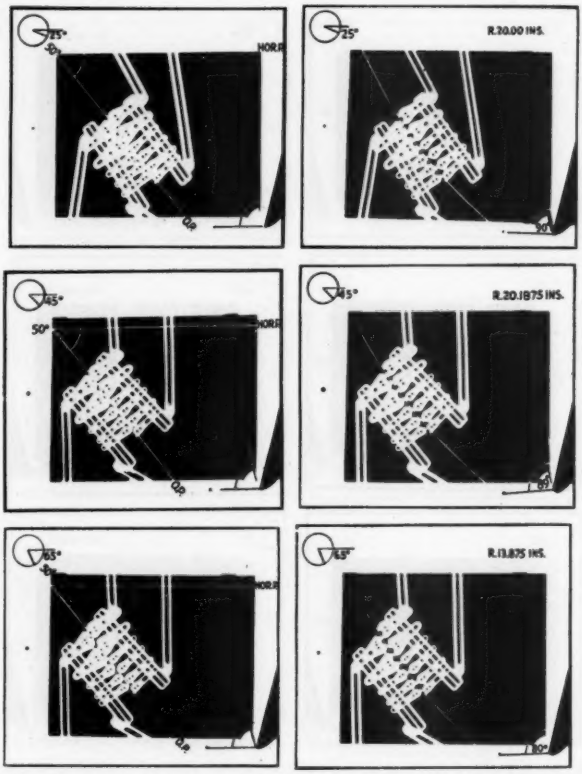

Fig. 11.—Silhouettes showing how, when plane of occlusion is kept slanted 50 degrees, increasing slant of straight condyle slot causes decrease in radius of curve of Spee.

silhouettes. In Figure 21, there are shown three positions of the assemblage articulated on a plane slanting five degrees. In the upper row, the assemblage was placed as far in the lower right corner as was convenient; in the middle of the same assemblage is set at 33 degrees, and it will be noted that the teeth no longer articulate. The teeth were then rearticulated on the 33 degree plane; the assemblage is moved about in different positions of the field, keeping it

on that plane, and the articulation is tested. The four positions in the lower right corner show how well the articulation is maintained in these four different positions. The difference in tooth position can be noted by comparing the upper left print with the two beneath it. Thus, it is demonstrated that the assemblage of teeth articulated on a given slant of the plane of occlusion in

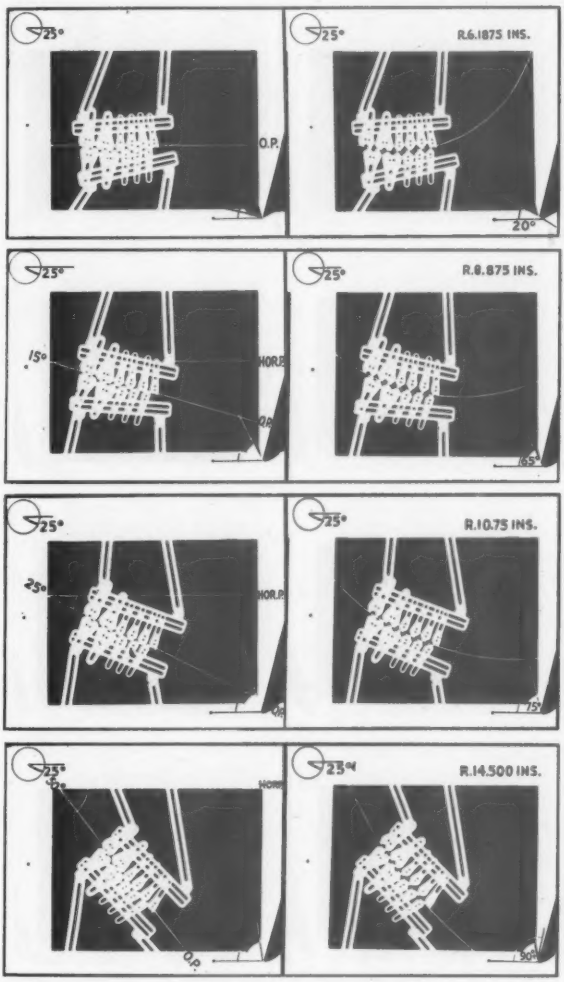

Fig. 12.—Silhouettes showing how, when curved condyle slot is kept at 25 degrees, increasing slant of plane of occlusion also increases radius of curve of Spee.

conformity with the dictates of a given slant of the condyle path may be set in different places in the field of the gnathokin and the articulative movement will be maintained, provided the same slant of the plane of occlusion is kept. In other words, the influence of the condyle path and the reaction of the teeth articulated to a given plane of occlusion produce the same resultant movements of the cusps in

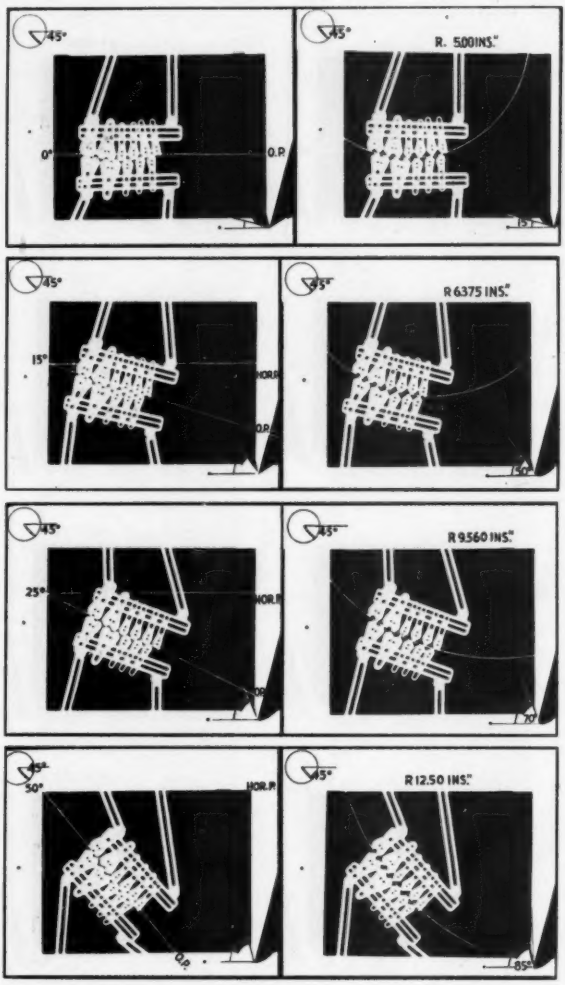

Fig. 13.—Silhouettes showing how, when curved condyle slot is kept at 45 degrees, increasing slant of occlusal plane increases radius of curve of Spee.

the different positions of the intergnathic field.

ditions of articulation, short cusps require a shorter radius in the curve of

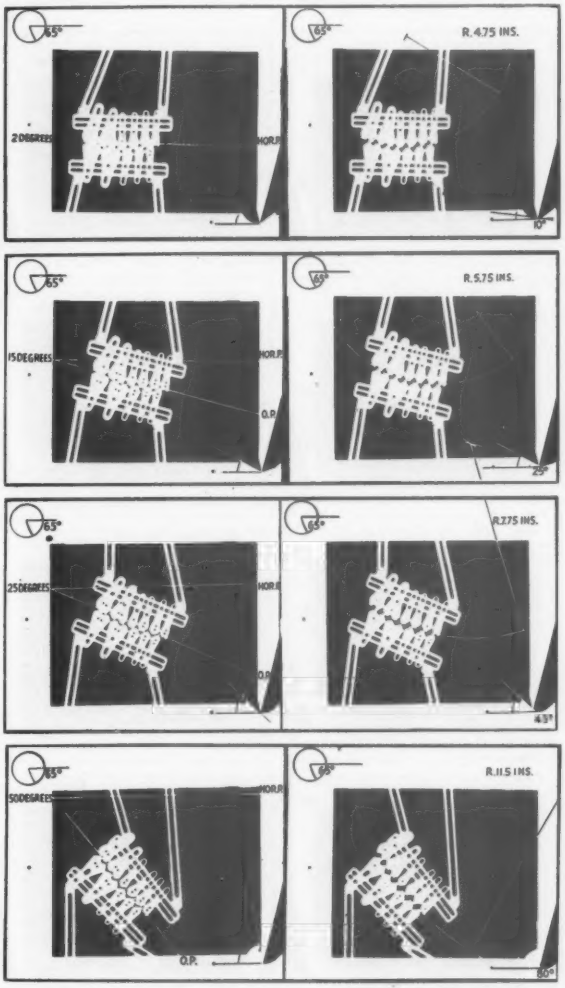

Fig. 14.—Silhouettes showing how, when curved condyle slot is kept at 65 degrees, increasing steepness of occlusal plane also increases radius of curve of Spee.

EFFECT ON THE CURVE OF SPEE OF THE HEIGHT OF THE CUSPS

It is well known that, for given con-

Spee than do long cusps. In fact, this is so well known that I have deemed it unnecessary to redemonstrate it here.

IMPORTANCE OF CENTRIC OCCLUSION

In the work on the gnathokin, the importance of maintaining the cuspal closure of the teeth in coincidence with the centric position of the mandibular arm, as determined by the most posterior position of the pin in the condyle slot, reemphasized the theme of a paper I wrote in 1932 on "Condylar Centricity and Cuspal Closure," which was a nat-

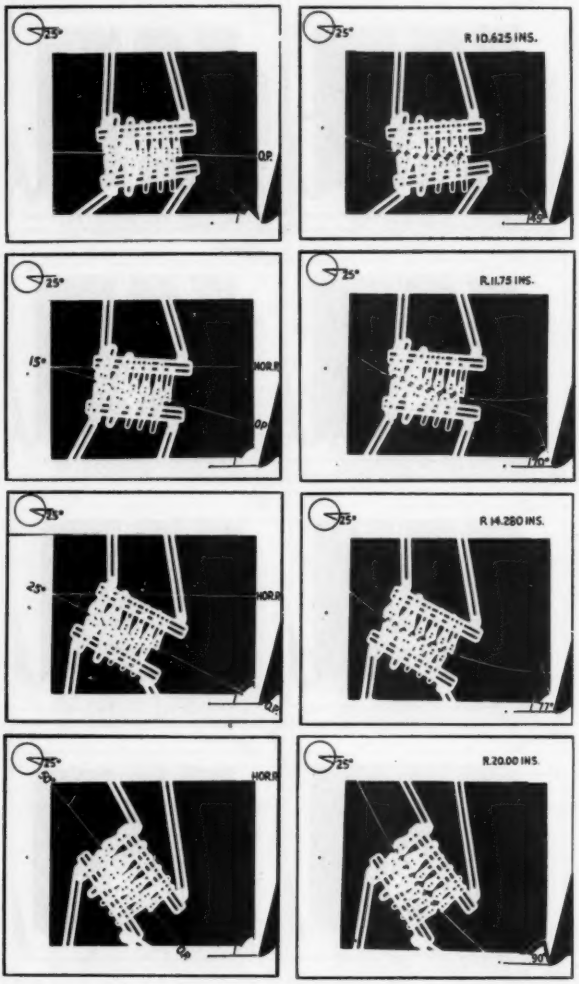

Fig. 15.—Silhouettes showing how, when straight condyle slot is kept at 25 degrees, increasing slant of occlusal plane increases radius of curve of Spee.

ural outgrowth of the experience I had in mounting gnathologically upon an articulator casts showing malocclusion. coincide with the anatomic centric position of the mandible, as determined by the mandible closing on its condylar axis

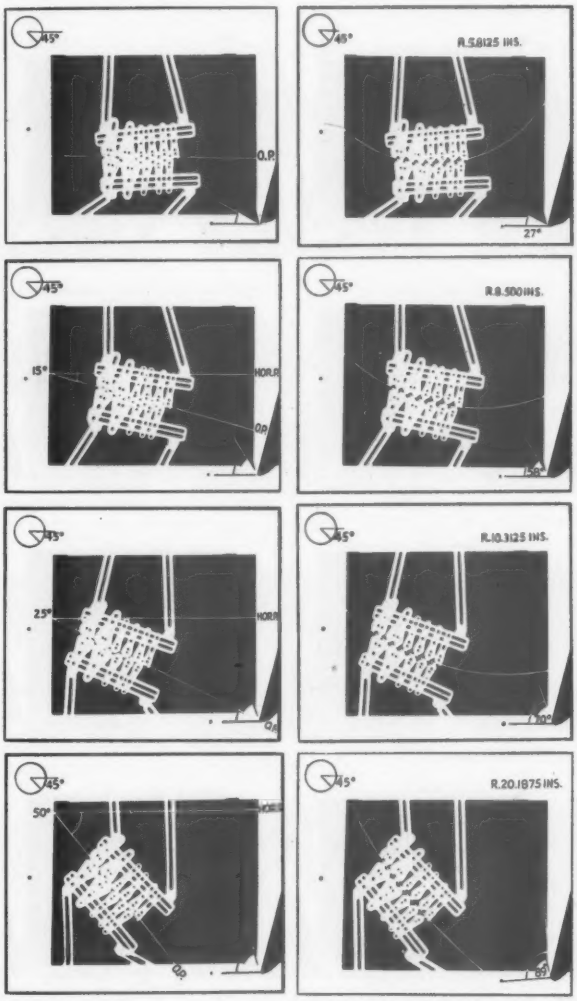

Fig. 16.—Silhouettes showing how, when straight condyle slot is kept at 45 degrees, increasing steepness of plane of inclusion increases radius of curve of Spee.

Much to my surprise, I found that the cuspal closures often do not agree or when it is in its proper posterior position. Schooled as I was in the usual concepts

of the profession, I had regarded it to be true that centric occlusion is determined by the interdigitation of the teeth and pair of plain models by a comparison with the closure noted in the patient, and believed that the inclined-plane occlusion

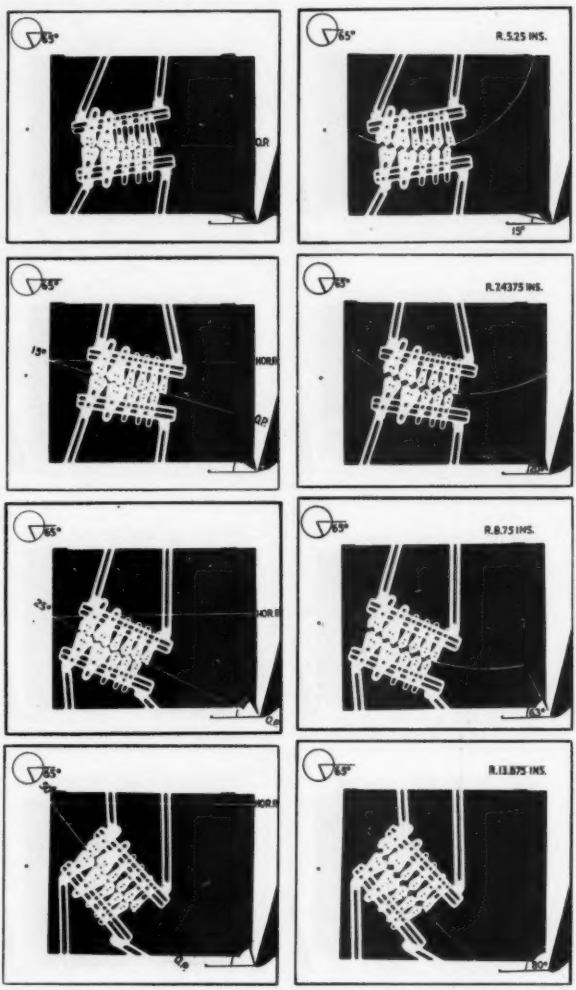

Fig. 17.—Silhouettes showing how, when straight condyle slot is kept at 65-degree inclination, increasing slant of occlusal plane increases radius of curve of Spee.

not by the centric position of the closed mandible. I had learned to articulate a would ultimately make the mandible assume a new centric position, and that it

mattered little if the mandible failed to translate its condyles forward. While using plain casts, I comprehended that, in cases like that of Figure 23, which was due to the closure being protrusive. Yet, it never occurred to me that, in cases like that of Figure 24, elongation of the maxillary arch would free the

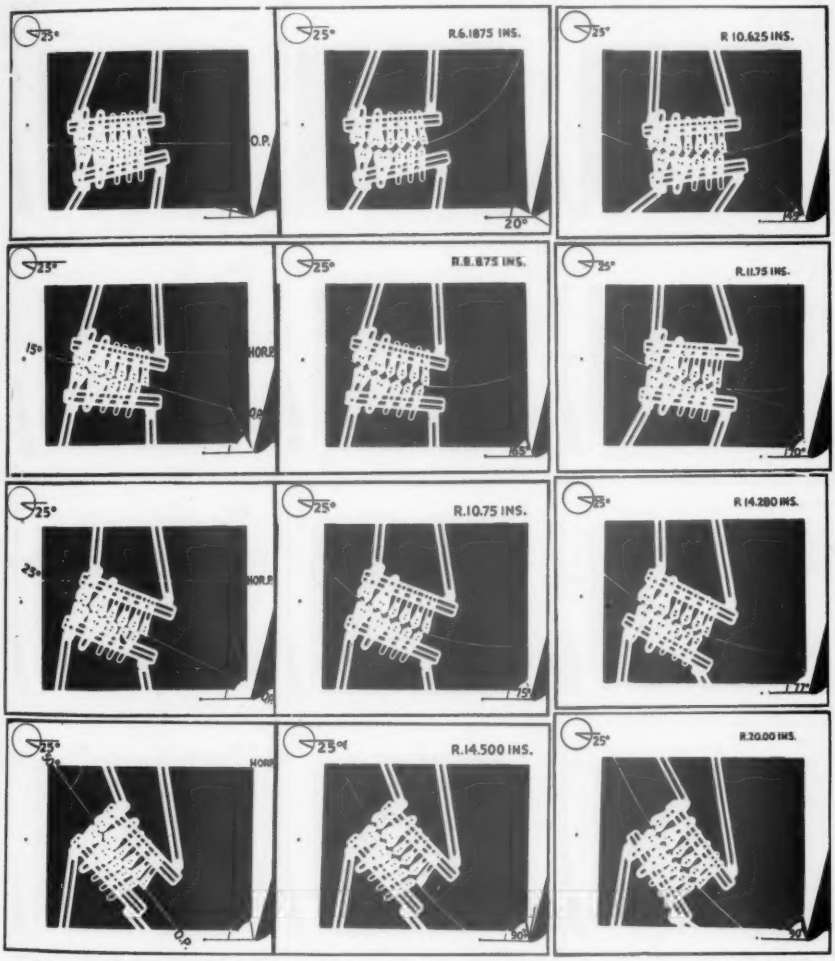

Fig. 18.—Summary of silhouettes of Figures 12 and 15, showing effect of condyle path and occlusal plane inclination on curve of Spee.

was treated by merely elongating the maxillary arch, a part of the deformity mandible and allow it to return to its centric position, complete distal occlusion

resulting. After I had accepted the use of gnathostatic models which are also occluded by a comparison with the closure made by the patient, I encountered the malocclusion shown in Figure 25, which, according to the closure made by the patient, appeared to be a mesial occlusion, commonly called Class III. As soon as the maxillary arch was expanded, distal occlusion was evident and I allowed it to develop until it reached the stage shown on the right in Figure 25.

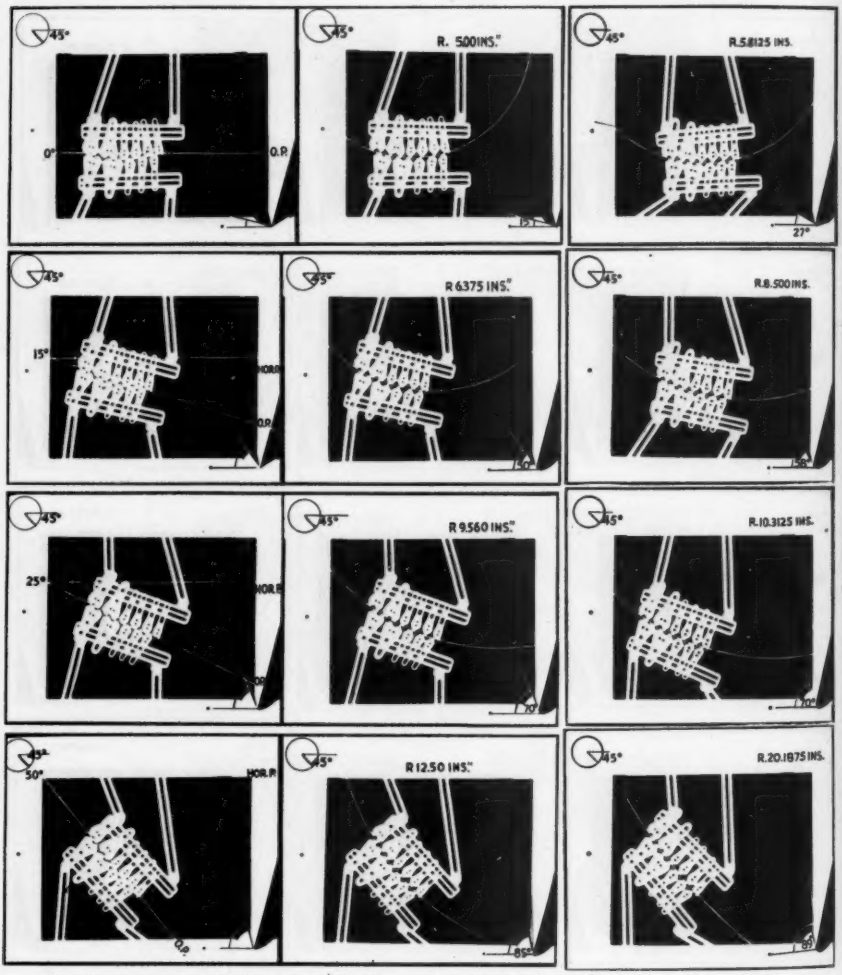

Fig. 19.—Summary of silhouettes of Figures 13 and 16, showing effect of character of condyle path and inclination of occlusal plane on curve of Spee.

This change in the apparent forms of malocclusion were noted by Dewey, who believed that malocclusion sometimes underwent metamorphosis from one class to another. I have concluded that, had I found the anatomic centric position of this mandible in the beginning, the models could have been related something like that in the center of the same figure. After such experiences, it became an accepted fact that it is necessary to determine, first of all, the centric position

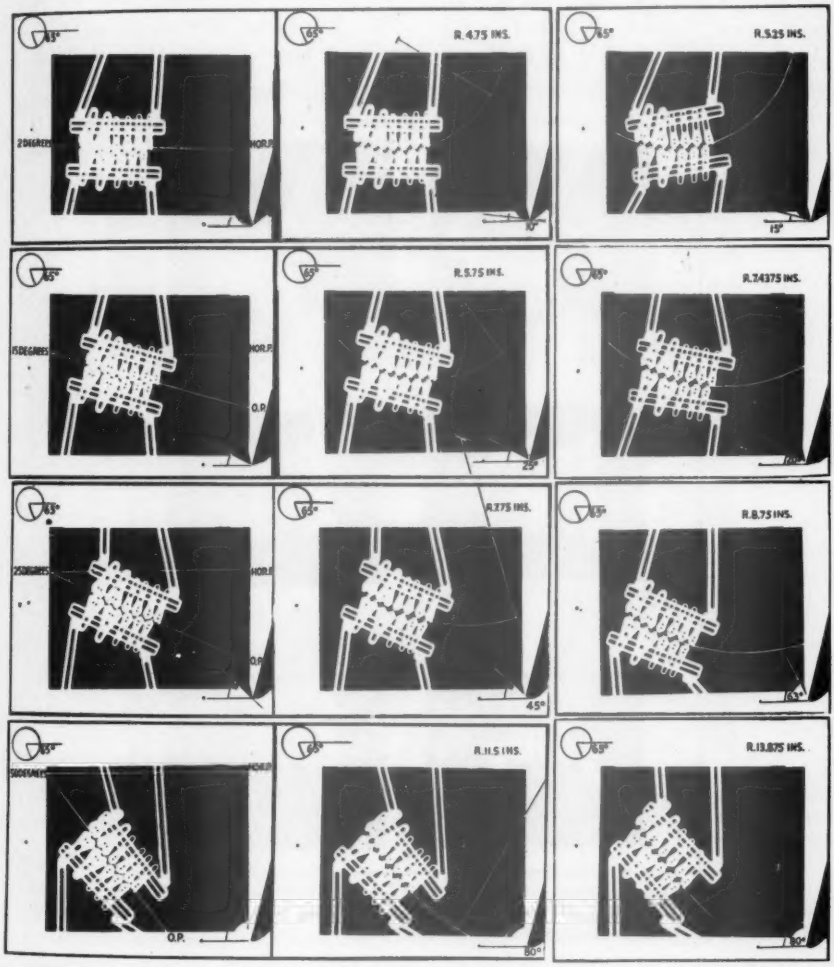

Fig. 20.—Summary of silhouettes of Figures 14 and 17, showing effect of character of condyle path and inclination of occlusal plane on curve of Spee.

of the mandible and record it by mounting the model upon a gnathographic instrument. The method I shall not now describe, since it is regarded as obsolete, not because it is too inaccurate, but because newer methods developed in the Gnathologic Society have made it possible to set the controls of the instrument by jaw writings instead of inaccurate wax bites of the lateral and centric mandibular positions. Besides, with these new methods, we shall be able to determine better the character of the condyle paths.

INADEQUACY OF DEFINITION OF CENTRIC OCCLUSION

No clear definition of centric occlusion has ever been given general emphasis.

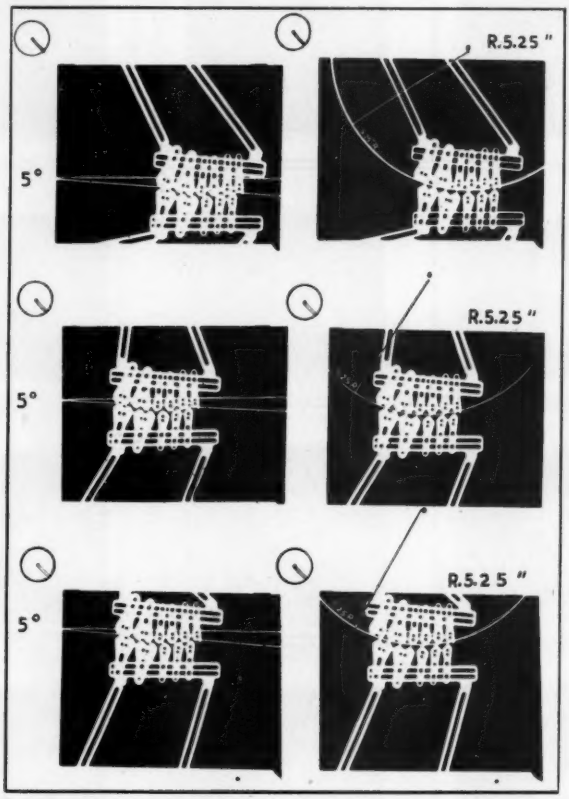

Fig. 21.—Silhouettes of same articulation placed in different locations of intergnathic field, but on same plane of occlusion slant; showing that articulation, to a certain degree, is independent of location of teeth, but dependent on other conditions.

The A.D.A. definition in the Standard Dental Dictionary states that "centric occlusion is the relation of the opposing inclined planes of the teeth when the jaws are closed in the position of rest."

Interpretations might make this definition seem correct, but, in its unexplained form, it gives no clue as to what the rest position for the mandible is, or on which of the following conditions it depends; namely, the interlocking of the teeth, muscular relaxation or the positions of the mandibular condyles. It is indefinite and misleading because it is incomplete. It never was intended to define normal or proper inclined plane relationships.

dible; that is determined primarily by the condyles being in their proper posterior positions in the temporomandibular articulations. To be sure, the shutting of the teeth stops the closure of the mandible, but they cannot determine its centric position. Whenever cusps guide the mandible either laterally or anteriorly, a protrusive closure is enforced and the occlusion is eccentric. In such an event, no matter how well the cusps interdigi-

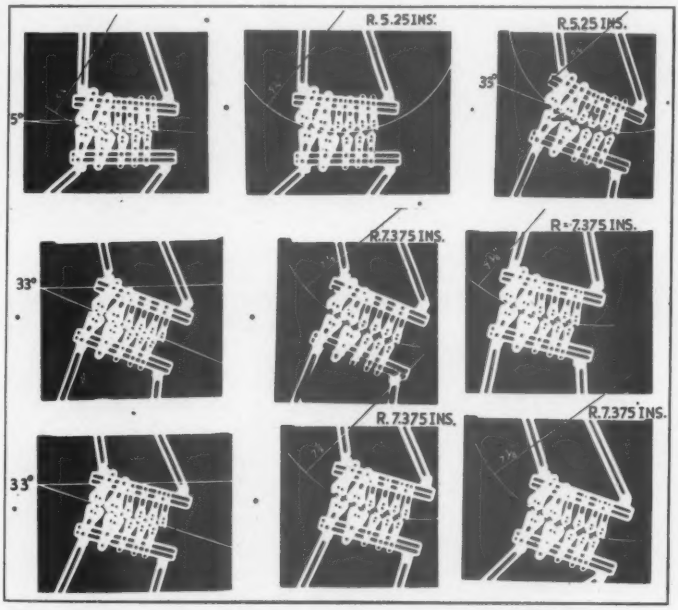

Fig. 22.—Upper articulation as in Figure 21, but showing that when tilted to 33 degrees occlusal plane slant, articulation is lost. The middle and lower tier show articulations of the same occlusal slant, condyle and condylar slant and are identical although placed in different locations in intergnathic field.

MEANING OF CENTRIC OCCLUSION

Centric occlusion might better be defined as the relation of the opposing teeth when the mandible is closed in the nonprotrusive position, i.e., in its centric position. The closed teeth do not determine the centric position of the mandible, or how nearly normal the opposing inclined planes of the teeth seem to be, the occlusion is eccentrically abnormal.

DETERMINATION OF CENTRIC OCCLUSION

To determine the centric occlusion of the cases of malocclusion to be shown

later, I used a facebow rigidly attached to the mandibular teeth by means of a specially cast aluminum alloy clutch and had the patient open and close without protrusion until I could locate a point near the tragus where the stylus of the facebow arm had only a rotation movement, which indicates the opening and closing mandibular axis. This point and a similarly located point on the other side of the patient's face were used to mount the maxillary cast upon the articulator by means of a facebow carrying an orbital indicator. Hence, the axis of the articulator (Fig. 26 *A*) represents the hinge axis of the mandible. The mandibular cast is related to the maxillary cast, during its mounting, by a centrically taken waxbite. In taking the waxbite, the patient was induced to close into the wax centrically, stopping the closure just before any cusps began to misguide the mandible. Since the casts are mounted by the facebow in the same

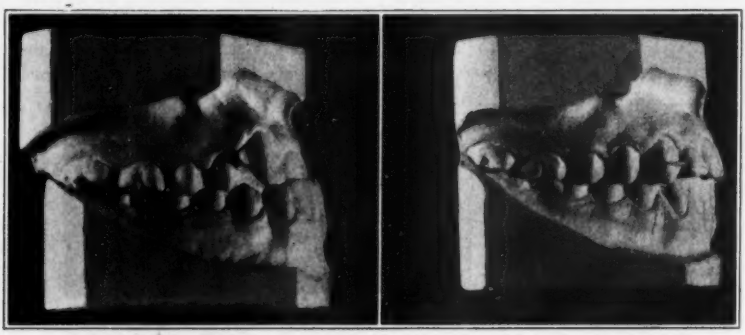

Fig. 23.—Pretreatment and posttreatment casts of case of functional mandibular protrusion.

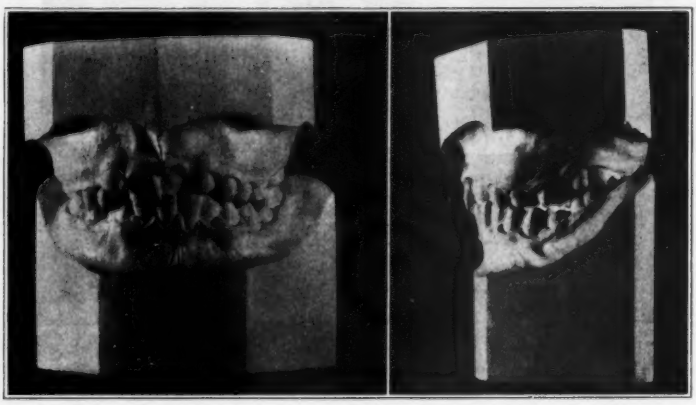

Fig. 24.—Malocclusion apparently of Class I variety. On treatment to free the interlocking of the left central and lateral incisor, the mandible moved into distal occlusion; which showed that closure was protrusive centric.

radial relation to the axis as the teeth bear to the condylar axis determined in the patient, the articulator will complete its closure, when the waxbite is removed, quite like the patient completes closure. If an eccentric cuspal closure exists in the patient, it will be recorded in the mounting by the ballbearing *B* being out of contact with the pin *P*. (Fig. 26 *B*.) It has been shown by such gnathologic mountings that eccentric cuspal closures of natural teeth frequently occur, and are likely to be caused by malarticulation of any of the posterior teeth, as well as of any of the anterior teeth. To augment the interest in the position of the hinge axis of the articulator, I have made an illustration of the condyle head with the ballbearing of the axis in centric position (Fig. 27), and another with the bearing in protrusive position.

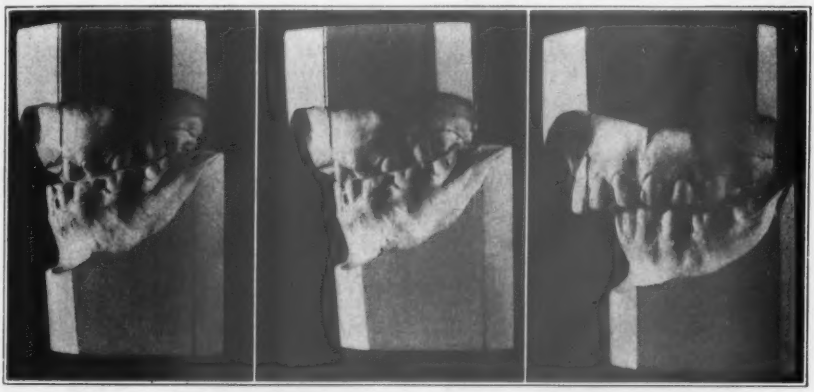

Fig. 25.—Left: Closure presented by case. Center: Probable closure if patient had been made to close anatomically. Right: Actual closure after permanent teeth had erupted.

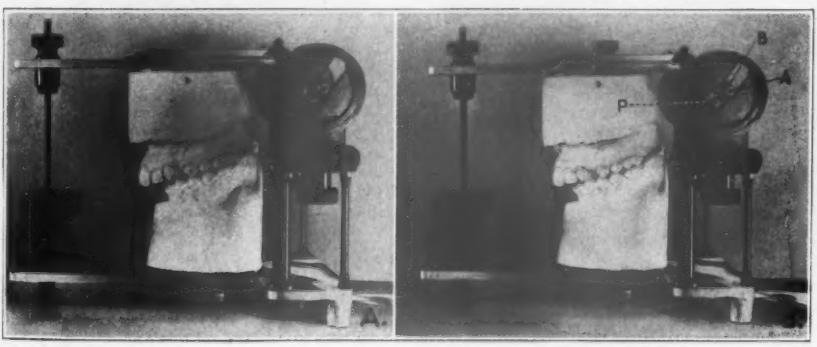

Fig. 26.—Gnathographic mountings of casts presenting malocclusion. *A*, centric closure. *B*, protrusive closure.

EXAMPLES OF ECCENTRIC CLOSURES

In most of the crossbites examined, the

cuspal closures are eccentric (Fig. 28 *A, B, C, D*), a condition noted but not proved characteristic by Lourie. In the malocclusion shown in this illustration, the intercast relations, while in centric closure, are indicated by the solid vertical pencil line. The dotted line on the lower cast, which coincides with the line on the upper cast when the latter is protruded, by its distance from the solid line, shows how much the closure is protrusive, almost a cusp's width. In advanced mandibular retraction (Fig. 29), often the cuspal closure is protrusive. It, no doubt, seems odd to state that the cuspal closure mesially from the maxillary bicuspids and distally from the mandibular cuspids. (Fig. 29 *C.*) It has been contended that the retruded incisors of Class II, Division 2, cause the mandible to be forced into distal occlusion. In Figure 30, a Class I case almost terminating in a Class II case, it will be noted by the mountings that the closure used is a protrusive one from which it is logical to deduce that the posterior teeth, principally the permanent molars, are forcing the mandible forward in closure. Mandibles are never forced backward by the occlusion, but are many times forced forward be-

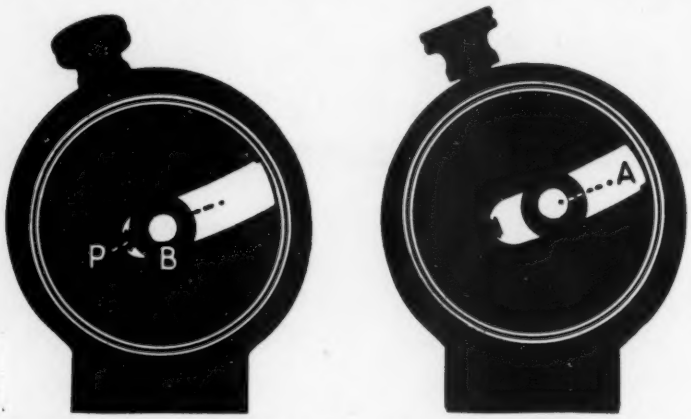

Fig. 27.—Roentgen-ray silhouettes of condylar mechanism of articulator. The figure to the left represents the centric position of the condyle; that to the right, a protrusive position of the condyle axis.

in a distal occlusion is a compelled protrusive one, yet such is often characteristic of mandibular retraction. Distal occlusion is usually a more severe deformation than the plain or gnathostatic cast would indicate. In the malocclusion shown in Figure 29, the mesial inclines of the maxillary bicuspids cause the protrusive closure. Often this forced protrusion is accompanied, and probably caused by, a characteristic diastema cause the cuspal closure does not coincide with the centric position of the teeth. In Figure 31, there is represented an extreme form of Class III malocclusion, attended with much contraction of the maxillary arch. But a glance at the hinge axis in the mounted casts will reveal that whatever protrusion is existing in the mandible is not anatomic but functional and is caused by the interlocking of one of the anterior maxillary teeth behind

the mandibular teeth. These few variations and occurrences of a lack of coincidence between cuspal closures and the centric position of the mandible reveal a feature of malocclusion that should be expected in every form of malocclusion; not that it is always present, but it might be. The detection of the amount of discrepancy between cuspal closure and the mandibular centric position can be reliably made only by gnathologic mountings.

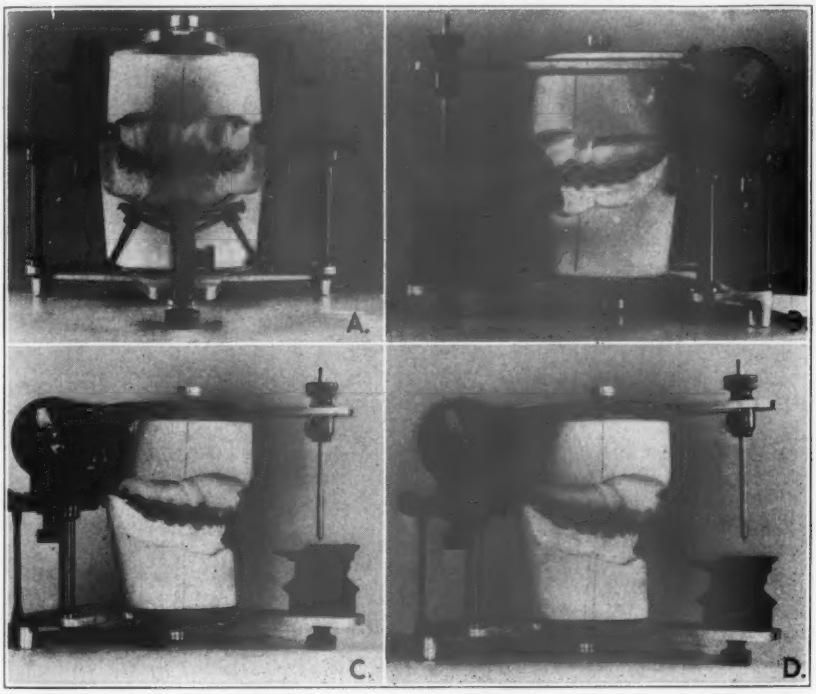

Fig. 28.—Mounted casts, illustrating cross-bite.

CENTRIC MAXILLOMANDIBULAR RELATIONS AND ARTICULATION

The centric maxillomandibular relations are not half so important to the anteroposterior articulation as to the laterocentric articulation. It is as impossible to articulate natural teeth in a protrusive closure as it is artificial teeth. The mandibular joints seem to be utterly incapable of functioning laterally when the teeth are occluded orthodontically in a protrusive maxillomandibular relation. It is believed that the condyles in distal occlusion can be coaxed by exercise to function in a forward position until they will not be returned to their former resting positions. The difficulty in believing this is that, in all observed cases of malocclusion in which the jaws are naturally forced into protrusion by interfering cusps, the joints never become adapted to the forward forced closures.

As soon as the forcing cusps are worn off, removed or depressed, the jaws return to their centric positions; i. e., the condyles retreat to their normal posterior positions. There is a reason, I believe, for this failure of joint adaptation. The mandible, if forced into protrusive closure, before it will move laterally, returns the rotating condyle to its proper posterior position, while the advancing condyle moves forward and downward. (McCollum, 1931.) Therefore, the original path of the condyle remains established, because, in every lateral mandibular motion, the rotating condyle keeps the dorsal end of its path cleared. The rear end of

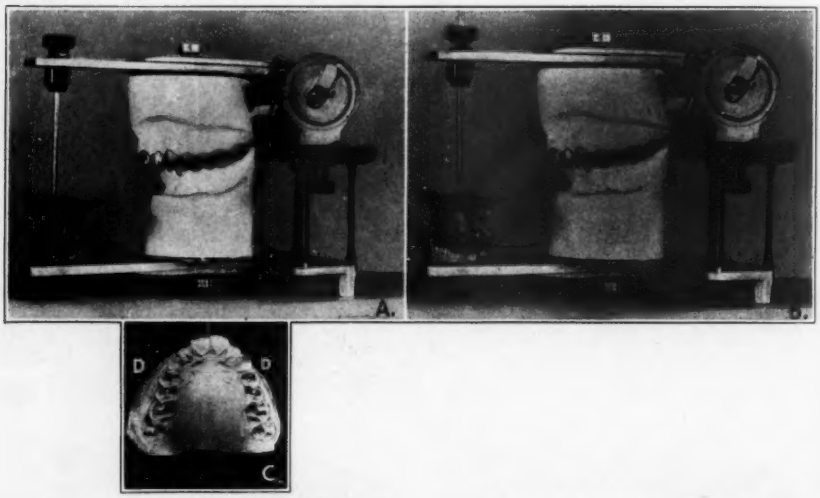

Fig. 29.—Functional protrusion shown in gnathographic casts of case of distal occlusion.

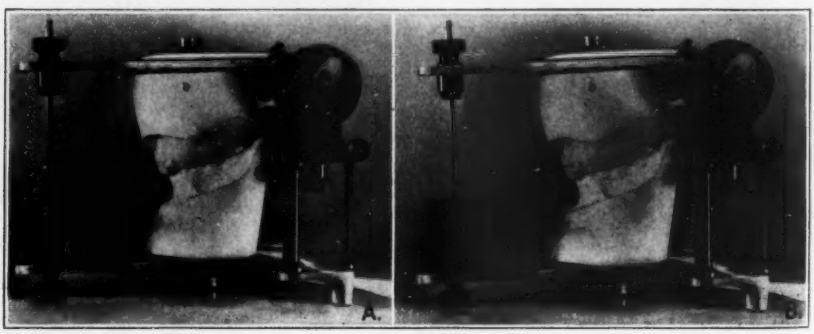

Fig. 30.—Class I malocclusion simulating Class II, division 2, in which protrusive centric position, for which posterior teeth were responsible, would indicate that upper incisors are not responsible for distal position of mandible.

the path is never given an opportunity to fill in new tissues to block the inevitable return of the rotating condyle. In Figure 32, there is represented a treated case of long standing in which the interdigitation of the teeth was based upon a protrusive closure. Most of the cusps are badly worn. It is believed also that a given closure of long cusped teeth, if held long enough by appliances or supported by protruding exercises, will ultimately lead to corrective adaptations in the jaw structures, and thus make the mandible either grow in length or translate the condyles forward until the framework of the dental apparatus matches the established closure. It is held that an established protrusive closure can make the mandible grow in length by elongating one or all of the following parts: the necks of the condyles, the ascending rami and the mandibular body. It is asserted, too, that orthodontic therapy can make the angles of the mandible more obtuse, which would elongate the mandible. But these are probably the least plastic parts of the mandible, and depending on them for alterations is like investing money in uncertain foreign lands. Even if these desired changes were known to be possible,

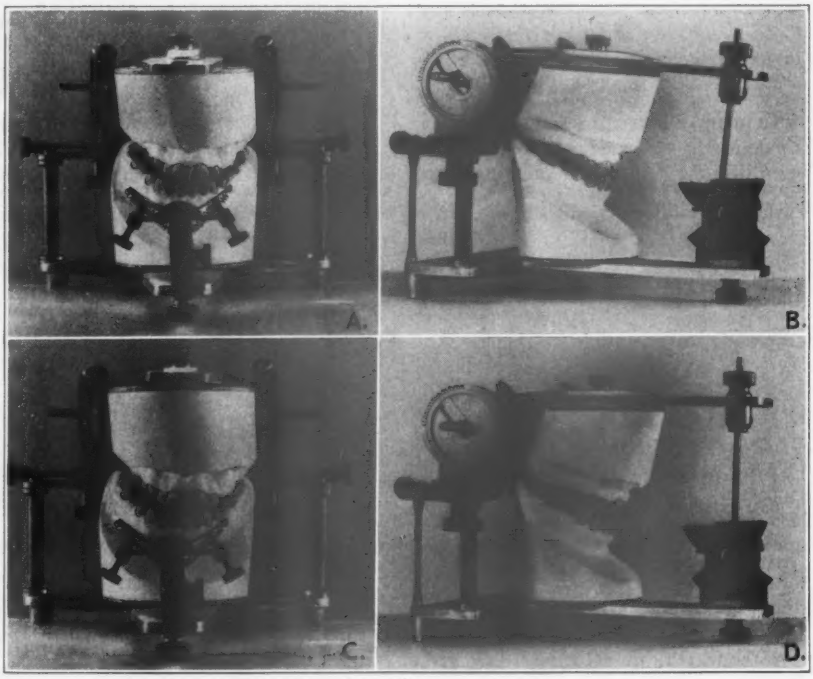

Fig. 31.—Extreme form of Class III malocclusion, attended with much contraction of maxillary arch. A glance at the hinge axis in the mounted casts will reveal that whatever protrusion is existing in the mandible is not anatomic, but functional, and is caused by the interlocking of one of the anterior maxillary teeth behind the mandibular teeth.

there would still be no reason to expect the treated teeth to have proper radial relations to the centers of jaw motion after the vainly hoped for adaptations occurred. Articulation cannot be obtained merely by enlarging the arches of the jaws; it must be obtained by relating the teeth to the centers of motions and by having the cuspal closure coincide with the anatomic centric position of the mandible.

ORTHODONTIA AND PROSTHODONTIA SIMILAR

In many respects, prosthodontia and orthodontia have so many problems in common that their diagnostic procedures and their applications of the principles of articulation should be quite similar. The prosthodontist, in each case, has given him the anterior and lateral paths of the condyles, the centric maxillomandibular relations and the arch form of the alveolar ridges. The orthodontist has given him the centric mandibular position, the anterior and lateral paths of the condyles, the arch forms of the apical bases of the teeth and the tooth forms. The prosthodontist may alter the alveolar ridges slightly by surgical measures, but the other factors he cannot modify directly or indirectly by causing growth adaptations. He can select the forms of the teeth, and he is free to arrange or grind them until they articulate. The success of his articulation depends chiefly on: (1) obtaining centric maxillomandibular relations; (2) placing the anterior teeth in proper relation with the lips; (3) locating the posterior teeth individually and collectively so that they will cooperate with the chewing movements, and (4) maintaining true cusp forms and ridges. The orthodontist cannot change the shapes of the teeth much by grinding and he cannot change the dimensions of the bodies of the mandible and the maxillary apparatus, if we are to believe the reasonable conclusions of Lundstrom. He cannot change the mandibular centric relations any more than can the prosthodontist. He might possibly be able to shorten long mandibles by using external appliances, but no one knows that this changes the centric position of the mandible. He cannot elongate short mandibles, except in nursing infants, and even if he could, he probably would not change the centricity of the mandible. Since, in all probability, he cannot change the maxillomandibular relations, nor make the temporomandibular articulations migrate, nor alter the slant

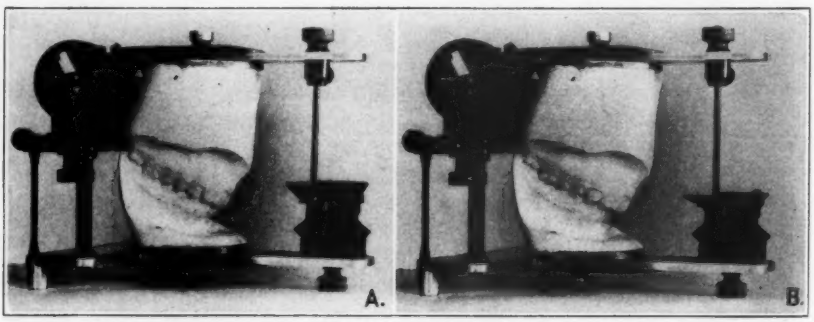

Fig. 32.—*A*, occlusion obtained by orthodontic treatment of protrusive closure. *B*, occlusal relations when teeth are closed centrically.

or the character of the condyle paths, nor modify the teeth, he has more fixed factors of articulation to deal with than the prosthodontist.

PROSTHODONTIC AND ORTHODONTIC ARTICULATION

The prosthodontist mounts the patient's casts upon an instrument that reproduces the jaw relations and movements. He articulates the teeth, two at a time, in the wax upon the mounted casts, experimenting in tooth position with impunity until he has gained articulation. He makes the wax more yielding by heat and uses his fingers or instruments in moving the teeth. He supplies from his own body the anchorage for the movements. His chief difficulties are: obtaining proper impressions and correct data for setting the articulator, having an anatomic articulator and maintaining, through the processing of the denture base, the tooth relations that he obtained in the wax. The orthodontist cannot take the teeth out of the patient's mouth and relate them upon an inert reproduction of the mouth. He cannot move the teeth with his fingers. Teeth are slick objects. They can be seized only by bands that occupy interproximal space. The orthodontist cannot melt the alveolar bone, he must keep it as solid as possible. He is limited in repeating the experiments in tooth positions. He derives his anchorage for tooth movements from the tissues of the alveolar processes. He accomplishes movements of the teeth by counterbalancing one banded tooth against another by a connecting wire inserted under tension, or by pitting one group of teeth against another group in the same arch or against all the teeth of the opposing arch. His "wax," the alveolar bone, will not set after he has gained the desired tooth positions: he has to make the connecting appliances hold the movements gained. Frequently, he must move teeth in all three spatial directions. Sometimes, it is necessary to move malposed teeth by pitting them against teeth that should not be moved. Many times, the appliances under the influence of chewing forces make undesirable and unwanted movements. The assembling of the appliances cannot be accurately done on models or in the mouth, but has to be done by estimating the amount and the direction of the force needed to overcome the clinically guessed resistance.

FACTORS OF ARTICULATION THAT MAY BE MODIFIED

The difficulties just recited have often been propounded by the doubtful to prove that it is impossible for orthodontists to place natural teeth in articulation. But orthodontists do use appliances that permit them to move teeth in any direction. They can, and do, alter the plane of occlusion and the radii of the curve of Spee. The position of the teeth can be changed. The teeth may be intruded, retruded or rotated, and they have a wide tolerance to intergnathic positions, being capable of assuming articulative relations in more than one position in the skull. These variable interrelating factors of articulation, namely, the curve of the cusps, the slant of the plane of occlusion, the position of the teeth, compromisible variations in the overbite, the overjet and the dentolabial relations, etc., are subject to change by the operator, and, fortunately, they are the chief factors that make it possible to interrelate given cusp forms and given condylar conditions. In most cases of malocclusion treated, when intraoral appliances are used, the treatment depends largely on altering the alveolar bone. In the simpler forms, ample possibilities of changing the alveolar processes are afforded the orthodontist for corrections without his depending on, or

hoping for, adaptations through growth in the distant and less plastic parts of the dental apparatus.

NEED FOR IMPROVEMENT IN DIAGNOSIS

If articulation becomes the aim of orthodontists generally, a new diagnosis will be developed, based, as it must be, upon a determination of the fixed factors of articulation, principally condylar conditions and tooth form; and by a knowledge of how these can be brought into harmonious cooperation through a change in the interrelated factors of articulation, the orthodontist may establish articulation through a planned treatment.

803 Medicodental Building.

COMPARISON OF PROCAINE HYDROCHLORIDE AND PROCAINE BORATE (BOROCAINE) AS LOCAL ANESTHETICS*

By M. L. TAINTER, M.D.; A. H. THRONDSON, D.D.S., and S. M. MOOSE, D.D.S., F.A.C.D., San Francisco, Calif.

THE problem of determining the value of a local anesthetic solution is often approached clinically by using the solution in question in a series of cases, and thus forming a general impression as to its efficiency. We have recently pointed out[1] that, in efforts to determine the value of local anesthetic solutions, there is a very large subjective factor that greatly influences judgment. That is to say, one's impression as to whether a local anesthetic is satisfactory almost certainly has a conscious or subconscious bias. The only way this can be avoided is to conduct tests in such a manner as to rule out the personal factor. This is conveniently done by means of the so-called "blind-test" procedure. By this method, the observers study the effects of administration of several solutions, some of which are employed as controls, without at the time knowing their identity. This gives data which are as nearly objective as possible, and from which any significant differences between the solutions can be reliably established, from a comparatively small number of cases. One hundred cases studied by such a controlled procedure will give results that are more reliable than ten or one hundred times as many studied by the usual hit or miss "clinical observation." This is particularly true of results with local anesthetics when conclusions must depend on the observer's judgment as to whether the anesthesia was satisfactory in each particular case

*From the College of Physicians and Surgeons, A School of Dentistry.

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1. Tainter, M. L., and Moose, S. M.: Practical Value and Limitations of Topical Anesthesia in Oral Surgery, J.A.D.A., 23:309 (Feb.) 1936; Studies in Topical Anesthesia. I Efficacy of Certain Common Anesthetics When Used on Gums, ibid., 23:244 (Feb.) 1936.

and whether any symptoms observed constituted a significant "reaction" that was due to the drug itself.

With these facts in mind, we have undertaken a clinical comparison of the action of procaine hydrochloride and of procaine borate (also known as ethocaine borate or borocaine). The borate salt has been advocated as an improved form of procaine, since it gives an alkaline solution the p_H of which is nearer that of the body than is the case with hydrochloride,[2] which is acid in reaction. The borate, being alkaline, might be expected theoretically to penetrate nerve tissue more readily than an acid solution, and, hence, produce more rapid and intense anesthesia. Such effects can be shown in laboratory experiments, and have been reported clinically,[3] but conclusive proof is lacking that the clinical results are actually different from those obtained with the acid salt. In this connection, it should not be overlooked that published data[4] indicate the fatal doses for animals to be the same for the hydrochloride and borate salts when the relative amounts of procaine in each are taken into consideration. These two local anesthetics were, therefore, particularly suited to the proposed study, since a comparison would give direct information on the relative merits of alkaline and acid solutions in local anesthesia.

METHODS

About a two-weeks' supply of the local anesthetic solutions was made up at a time by one of us, who alone knew their composition. As one lot of solution was exhausted, another was supplied, with alternation irregularly between the two solutions in question, and the use of each one under several different numbers. The procaine hydrochloride was used as a 2 per cent solution in distilled water, kept in pyrex flasks of 50 c.c. capacity and sterilized with steam under pressure. The solutions of procaine borate could not be sterilized in this way, since they were rapidly decomposed by heat. Instead, 2 gm. of the dry powder was placed in sterile flasks of 50 c.c. capacity and sterile distilled water was added just before using. This gave a 4 per cent solution of the borate, which contained the same amount of procaine base as did the 2 per cent solution of the hydrochloride. One cubic centimeter of a 1:1,000 solution of epinephrine was added to each flask to give a 1:50,000 end concentration of the vasoconstrictor agent just before using. These solutions were used routinely in the oral surgery clinic under the continuous observation of one of us, who did not know the composition of the solutions. Each patient was carefully observed as to type of operation, volume of solution used, course of anesthesia, reactions, etc., and, was usually seen on subsequent days for data on the after-effects. All the observations were recorded at the time on suitable mimeographed forms. At the conclusion of the study, these observations were segregated according to the solutions used, and the results evaluated statistically.

A word might be said about the desirability, if not necessity, of submitting such data to statistical analysis. In a large series of observations, a given phenomenon, such as the time of onset of anesthesia, might develop in an average time of three minutes for the whole series. In any individual case, the observed time is probably not exactly three

2. Copeland, A. J., and Notton, H. E. F.: Brit. M. J., 2:547 (Sept. 26) 1925.

3. Freeman, C. W.: D. Cosmos, 71:949 (Oct.) 1929.

4. Dailey, H. T.: D. Cosmos, 71:945 (Oct.) 1929. Watson-Wallace, E.: Lancet, 1:16 (Jan.) 1926.

minutes, but rather some figure either above or below this average. If only a few cases are studied, the average is not very likely to be near the true one, but either above or below it, depending on how far apart the individual values are, and how many high or low ones happen to be included in the values that are being averaged. Formulas have been developed which, if the range or spread of the individual values and the number of cases from which the average is obtained are taken into account, enable one to predict how reliable the value for the average actually is. That is to say, a value, called the probable error, can be calculated. This probable error means that if this same series of observations were repeated over and over again until many similar averages were obtained, half of them would be not more than the amount of the probable error above or below the true average. About five averages out of six would not be more than twice the probable error away from the true average, and twenty-two out of twenty-three would be not more than three times the probable error away from the true average, and so on. Comparison of the average anesthesia time assumed above of three minutes with one of four minutes observed with an unknown anesthetic solution could be made by using the probable error; which makes it possible to predict the chances there would be for a four-minute average to be obtained from observations on a three-minute-drug, by an accidental grouping of the patients who required the longer periods for the anesthesia to develop. In other words, it is possible to calculate the chance that the one-minute difference observed between these two solutions was a real difference, or the odds that it was the result of a chance grouping of individual results. Generally, a probability or odds of 20 to 1 are considered to indicate a reliable difference; but this will depend on the type of material being handled and the use to which the values are put. The theories and formulas used to calculate the probable error and probability are set forth in many standard works on statistics[5] and need not be further developed here. The use of such methods of handling the data in this study allowed us to indicate which differences between the solutions were significant and which were probably the result of chance variation.

Measurements of the acidity of each lot of solution were made with Michaelis' nitrophenol indicators. The 2 per cent solutions of procaine hydrochloride had a p_H of 5.6, and so were well over on the acid side. The 4 per cent solution of procaine borate had a p_H of 8.1, or somewhat greater alkalinity than the blood, the p_H of which is 7.4.

The osmotic pressure of each solution was measured by the depression of the freezing point, which readily tells whether the solution is isotonic with blood. An isotonic solution freezes at 0.56 degrees below zero. In other words, there is enough material dissolved in the water to depress the freezing point 0.56 degrees centigrade below the temperature at which distilled water freezes. The 2 per cent solution of procaine hydrochloride gave, as an average of many observations, a freezing point of 0.262 C. below zero. Therefore it had only $\frac{0.262}{0.560}$ or approximately one-half of the isotonic osmotic pressure, and hence was definitely hypotonic. The 4 per cent solution of procaine borate gave a freezing point of 0.565 C. below zero, and hence, was almost exactly isotonic. An

5. Fisher, R. A.: Statistical Methods for Research Workers, Ed. 5, London: Oliver and Boyd, 1934. Pearl, R.: Introduction to Medical Biometry and Statistics, Baltimore: Williams and Wilkins, 1930.

absence of any practical difference in local anesthetic efficiency of these solutions would indicate that hypotonicity as marked as that of the hydrochloride was not significant for the usefulness of the procaine.

TYPES OF CASES USED

A total of 231 patients were used in this series; i.e., 113 being given procaine hydrochloride, and 118, procaine borate. Practically all were extraction cases. In certain patients, there was more than one injection, the total number of injections in all patients being 340, equally divided between the two solutions. Infraorbital injections amounted to 28 per cent of the total for the hydrochloride and 33 per cent for the borate. Forty-two per cent of the hydrochloride and 36 per cent of the borate injections were mandibular, while tuberosity injections accounted for 30 per cent of the hydrochloride and 31 per cent of the borate injections. The type of cases were thus quite evenly distributed between the two anesthetics, and, therefore, the two solutions were compared on quite similar groups of patients. A total of 268 teeth were extracted from the patients receiving procaine hydrochloride, an average of 2.37 teeth for each patient, and 289 teeth from the patients receiving procaine borate, an average of 2.45 teeth for each patient. Hence, the average number of extractions also agreed well in the two series.

Table 1 summarizes the volumes of solution required to produce anesthesia, as well as related data. The smallest volumes used with each patient was 2 c.c., the largest, 15 c.c. With the procaine hydrochloride, an average of 4.6 c.c. was required, with the borate 4.8 c.c. There was, therefore, only a difference of 0.2 c.c. in the average volume of anesthetic solution required. The calculated probability (Table 1) discloses that the odds were definite that this difference was due to chance, and, therefore, there was not a real difference in the volumes of solution for the two drugs. These values do not confirm the claim that less of a procaine borate solution is required than of a procaine hydrochloride solution for local anesthesia.

COURSE OF LOCAL ANESTHESIA

Time of Onset.—The average time of onset of anesthesia was three and three-tenths minutes for the procaine hydrochloride and three and one-tenth minutes for the procaine borate, the range of distribution being similar. (Table 1.) Therefore, there was a difference of two tenths minute in favor of the borate. The probability figure shows that the odds were marked that this small difference was a chance variation, and hence was not indicative of a real difference. Therefore, the time required for the onset of the anesthesia was quite similar for the two solutions.

Duration.—Anesthesia lasted an average of two and one half hours with procaine hydrochloride and two and six-tenths hours with procaine borate; a small difference well within the range of chance variation. Hence, there was no significant difference in the duration of anesthesia with the two solutions.

Completeness.—There were no cases wherein anesthesia completely failed, nor where sufficient anesthesia was not present to permit completion of the operative work. There was some sensation of pain in 26 per cent of the patients receiving procaine hydrochloride, and in only 21 per cent of those receiving the borate. Thus, there was a difference of 5 per cent in favor of the borate, the probability being 6.2 to 1 against this being a chance variation. Accordingly, it appeared probable, but not certain, that

TABLE 1.—COMPARATIVE EFFICIENCY OF PROCAINE HYDROCHLORIDE AND PROCAINE BORATE AS LOCAL ANESTHETICS BY INJECTION*

Solution	Average Volume Required. C.c.	Average Time of Onset Anesthesia Min.	Average Duration of Anesthesia Hr.	Degree of Anesthesia No. of Cases		Pain on Injection No. of Cases		Amount of Bleeding No. of Cases			Proportion of Completely Satisfactory Cases
				Complete	Partial	None	Slight	Slight (trace, up to 2 drops)	Moderate (2 drops to 0.2 c.c.)	Excess (over 0.2 c.c.)	
Procaine hydrochloride, 2 per cent in distilled water	4.6 (2.0-15.0)	3.3 (2.0-14.0)	2.5 (1.0-6.0)	86 74%	30 26%	92 81%	21 19%	19 16%	76 66%	21 18%	91%
Procaine hydrochloride; probable error of average	0.15	0.12	0.07	2.8%	2.8%	2.5%	2.5%	2.3%	3.0%	2.4%	1.8%
Procaine borate, 4 per cent in distilled water	4.8 (2.0-15.0)	3.1 (1.0-12.0)	2.6 (0.5-6.0)	101 79%	27 21%	101 90%	11 10%	23 21%	68 63%	17 16%	89%
Procaine borate; probable error of average	0.15	0.11	0.10	2.4%	2.4%	1.9%	1.9%	2.6%	3.2%	2.4%	2.0%
Critical ratio†	0.37	0.42	0.24	2.2	2.2	4.3	4.3	2.3	1.2	0.9	1.1
Probability	<1	<1	<1	6.2	6.2	267	267	7.3	1.4	<1	1.2

*Each solution contained 1:50,000 epinephrine hydrochloride.

†In this table and Table 2, the critical ratio is obtained by dividing the difference between the two averages by the probable error. This shows how many times greater the difference is than the probable error of the averages. The probability indicates the odds against such a critical ratio occurring by chance alone. The figures in parentheses are the extreme values observed.

procaine borate produced complete anesthesia in about 5 per cent more of the patients than did the hydrochloride under these clinical conditions, and was slightly more effective in completely blocking the nerves.

Irritation.—In 19 per cent of the patients who received procaine hydrochloride, there was slight, immediate pain at the site of injection. This was the case in only 10 per cent of the patients receiving procaine borate. Such a large difference, i.e., 9 per cent out of 19, is highly improbable (267:1) from chance alone. Hence, the borate caused tissue irritation at the moment of injection in only about one-half as many cases as did the hydrochloride. The pain was very minor in any case, but worthy of consideration in the total evaluation of the relative merits of the two solutions.

Bleeding.—An attempt was made to estimate the amount of bleeding from the extractions, as an index of the relative efficiency of the vasoconstrictor in the two solutions. Each solution contained 1:50,000 epinephrine, and so, at the time of preparation, should have been of equal vasoconstrictor potency. The amount of blood lost was estimated in each case by the same observer throughout. The data have some relative significance, even though they were much less accurate than they would have been if a more reliable method of measuring the blood-loss had been used. The results (Table 1) indicated a very slight tendency toward less bleeding with procaine borate than with the hydrochloride, the odds being so low, in view of the crude method of estimation, as to make it uncertain that there was any real difference between the two solutions in this respect.

A summary of the cases according to the operator's impression as to whether the anesthesia had been perfectly satisfactory showed that 91 per cent of the patients receiving procaine hydrochloride were in this category, as compared with 89 per cent receiving the borate. Therefore, little or no difference in the satisfaction of the operator with the anesthesia was indicated, both solutions being successful nine out of ten times.

SYSTEMIC REACTIONS

Any systemic reactions during the course of the local anesthesia were carefully noted according to symptoms of fainting, perspiration, nervousness, tremors and changes in pulse rate, blood pressure and respiration. Measurement of changes in the latter functions were made before injection was started, as a control, and again five minutes after the injection was completed; i.e., when the greatest systemic reaction generally occurs. The data are summarized in Table 2.

Pulse Rate.—After procaine hydrochloride administration, the pulse rate did not change in 5 per cent of the patients, dropped an average of eight and four-tenths beats per minute in 29 per cent and increased an average of twelve beats per minute in 66 per cent. (Table 2.) The average of the whole series was an increase of five and five-tenths beats per minute. The greatest changes seen were an increase of thirty-four beats in one case and a fall of thirty-eight in another. After administration of the procaine borate, the results were very similar; 11 per cent of the patients showing no change in pulse rate, 25 per cent a decrease averaging fourteen and one-tenth beats, and 64 per cent an increase averaging thirteen and six-tenths beats per minute. The net effect after the borate was an increase of five and four-tenths beats per minute. The greatest changes seen with the borate were an increase of seventy-two beats per minute in one patient and a decrease of fifty-six in an-

how many times greater the difference is than the probable error of the averages. The probability indicates the odds against such a critical ratio occurring by chance alone. The figures in parentheses are the extreme values observed.

other. The average differences between the two solutions were obviously insignificant, indicating that the actions on pulse rate of these two drugs were very similar.

Blood Pressure.—Administration of procaine hydrochloride caused no change in systolic blood pressure in 4 per cent of the cases, a fall in 42 per cent averaging 10.7 mm. Hg. and a rise in 54 per cent averaging 10.3 mm. The net change in all cases was a rise averaging 1.1 mm. The greatest changes were a rise of 40 mm. and a fall of 48 mm. Procaine borate administration produced no change in systolic pressure in 2 per cent of the patients, a fall averaging 11.6 mm. in 35 per cent and a rise averaging 12.5 mm. in 63 per cent. The net change was a rise of 3.9 mm., with an extreme rise of 44 mm., and a fall of 54 mm. Therefore, the average rise was 2.8 mm. greater in the borate series than in the hydrochloride, and 9 per cent more of the patients had an increase in systolic blood pressure after the borate than after the hydrochloride. The odds were 6.3 to 1 against these differences being due to chance variation, and, hence, were probably real, but the differences were too small to be clinically significant. Accordingly, a little more than one-half the patients given injections had rises; about one out of thirty showed no change, and the remainder had decreases in systolic blood pressure. The differences between procaine hydrochloride and procaine borate, as regards systolic blood pressure, were too small to be demonstrable under ordinary clinical conditions.

While the predominant effect on systolic blood pressure was a rise, that on diastolic pressure was a fall, with both solutions. Thus, 5 per cent of the patients receiving procaine hydrochloride showed no change in diastolic pressure, 28 per cent a rise averaging 8.9 mm. and 67 per cent a fall averaging 8.6 mm. The average change in the whole series was a fall of 3.5 mm., with an extreme rise of 44 mm. and a fall of 40 mm. With procaine borate, 6 per cent showed no change in diastolic pressure, 33 per cent an increase averaging 6.8 mm., and 61 per cent a decrease averaging 9.3 mm. The net change in the whole borate group was a fall of diastolic pressure of 3.5 mm., with an extreme rise of 30 mm. and a fall of 44 mm. As the average changes in diastolic pressure in the two series were identical, no difference between them was demonstrated. The values in Table 2 showed clearly that, with either solution, the predominant effect was a rise of systolic blood pressure accompanied by a fall of the diastolic.

Respiration.—The effects on respiration with both solutions were rather variable. With procaine hydrochloride, there was no change in respiratory rate in 29 per cent of the patients, a decrease in 38 per cent averaging three and two-tenths per minute and an increase in 33 per cent averaging five and two-tenths per minute. The average net result was an increase of five-tenths respiration per minute, with an extreme increase of twenty, and a decrease of eight, per minute. With the borate, there was no change in 27 per cent, a decrease in 31 per cent averaging three and eight-tenths respirations per minute and an increase in 37 per cent averaging five and five-tenths per minute. The net result was an average increase of four-tenths respiration per minute, with extremes of twelve per minute in both directions. Accordingly, the changes in respiratory rate were small and inconstant with both solutions, and without significant differences.

Subjective Symptoms.—There were

TABLE 2.—COMPARATIVE EFFICIENCY OF PROCAINE HYDROCHLORIDE AND PROCAINE BORATE AS LOCAL ANESTHETICS BY INJECTION*

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Solution	Immediate Systemic Changes								Late Effects (Number of Cases)			
	Pulse Rate Average Beats per Minute	Blood Pressure		Respiratory Rate Average per Minute	Perspiration No. of Cases	Nervousness No. of Cases	Tremors No. of Cases	Fainting No. of Cases	Reaction at Site of Injection	Trismus	Reaction at Site of Operation	Septic Alveolus (Dry Socket)
		Systolic Average Mm. Hg.	Diastolic Average Mm. Hg.									
Procaine hydrochloride, 2 per cent in distilled water	+5.5 (+34 to −38)	+1.1 (+40 to −48)	−3.5 (+44 to −40)	+0.5 (+20 to −8)	11 9.7%	36 31.8%	10 9%	7 5.4%	20 18%	30 26.5%	67 60%	5 4.4%
Procaine hydrochloride; probable error of average	0.74	0.9	0.7	0.3	1.9%	3.0%	1.8%	1.4%	2.6%	2.8%	3.1%	1.3%
Procaine borate, 4 per cent in distilled water	+5.4 (+72 to −56)	+3.9 (+44 to −54)	−3.5 (+30 to −44)	+0.4 (+12 to −12)	13 11%	43 36.5%	20 17%	13 11%	24 20%	24 20%	53 45%	2 2%
Procaine borate; probable error of average	1.0	0.9	0.7	0.3	1.9%	3.0%	2.3%	1.9%	2.5%	2.5%	3.1%	0.9%
Critical ratio	0.08	2.2	0	0.12	0.7	1.9	4.0	3.1	0.9	2.8	6.0	1.6
Probability	<1	6.3	0	<1	<1	4.0	142	26.4	<1	16.0	19300	2.6

*Each solution contained 1:50,000 epinephrine hydrochloride.

certain significant differences in the symptoms that the patients experienced subjectively. With procaine hydrochloride, 5.4 per cent of the patients had fainting spells sufficiently severe to require lowering the head. With procaine borate, the incidence of fainting was more than twice as great, affecting 11 per cent of the cases. The odds were 26.4 to 1 against this difference being due to chance; therefore the borate may cause about twice as much fainting as the hydrochloride. Similarly, there was a higher incidence of nervousness and of tremors in the patients receiving procaine borate, the differences being probably statistically valid. There was also a slightly greater percentage of the same patients who broke out in perspiration, although the difference was not great enough to be reliable. Taking all of these four phenomena together, the general conclusion was inescapable that there was a significantly greater incidence of subjective symptoms in the patients receiving procaine borate than in those receiving procaine hydrochloride.

An attempt was made to determine whether the subjective symptoms occurred more often in patients with an initial hypertension of over 140 mm. systolic blood pressure or 90 mm. diastolic, or in those with hypotension, with systolic pressures below 110 or diastolic below 65 mm. Hg. When all the patients were grouped according to the control blood pressures, it was found that there was an even percentage distribution of the cases presenting fainting, perspiration, nervousness and tremors, etc., among the hypotensive, normal and hypertensive groups. Apparently, such subjective reactions were not more common in the supposedly "bad risks" than in the "good risks." The circulatory and respiratory changes were also not different from those of the normal group.

LATE EFFECTS

One of the main claims of the advocates of procaine borate is that, since the p_H of the solution is near that of the body, it is less liable to irritate the tissues and nerves at the site of injection. The patients of this series were examined the day after the operation, and evidences of local tissue injury were noted. There was swelling or inflammation at the site of injection in 18 per cent of the patients receiving procaine hydrochloride and in 20 per cent of those receiving the borate. (Table 2.) This difference is too small to be significant. It is concluded that procaine hydrochloride solution failed to produce an increase in the direct, local damage to the tissues, despite its hypotonicity and high acidity.

There were significant differences in favor of procaine borate when other late effects were considered. Trismus was present in 26.5 per cent of the patients receiving procaine hydrochloride, but in only 20 per cent of those receiving the borate. There was pain and swelling at the site of the operation in 60 per cent of the patients receiving the hydrochloride and in only 45 per cent of those receiving the borate. Septic alveoli (dry sockets) occurred in 4.4 per cent of patients receiving procaine hydrochloride and in only 2 per cent of those given the borate. These differences were probably all significant, with the possible exception of the septic alveoli. It is concluded that the procaine borate solution produced less after-effect in the areas of operation than did the procaine hydrochloride solution.

It is somewhat difficult to explain these differences, as the changes occurred in tissues with which the anesthetic solution did not come in contact, since the operative fields were not infiltrated. They could not be explained by the kind of block anesthesia used, since each group

of mandibular, infra-orbital or tuberosity injections had their proportionate share of these late reactions. It is possible that the alkalinity of the borate solution facilitated the destruction of epinephrine in the tissues, and, hence, promoted restoration of the local circulation; or, it may have promoted absorption of the epinephrine. There was evidence that the procaine borate was probably absorbed more rapidly than the hydrochloride, since its administration caused greater systemic reactions. This tendency would be consistent with less complete or lasting local vasoconstrictor effect from administration of the epinephrine. Whatever the explanation, there was at least no interference with the duration of anesthesia, as judged by the results obtained.

DISCUSSION AND SUMMARY

The data of this investigation, obtained under unusually reliable conditions, were interesting for what they failed to show, as well as for what they did show. It was significant that the published impressions that a smaller volume of procaine borate (alkaline) solution is required for local anesthesia, that anesthesia comes on sooner and that it may not last so long when compared with that of procaine hydrochloride were not sustained by objective measurements in actual cases adequately controlled and compared. The procaine borate solution did seem to show a slight superiority in that it produced complete anesthesia in a slightly greater percentage of cases than did the hydrochloride solution. Also, injection of the borate was completely painless in 9 per cent more of the patients than was injection of the hydrochloride, but this was found to be a small and insignificant point of superiority for the borate. Although the alkaline procaine borate administration did not appear to cause less inflammation or swelling at the point of injection than did that of the hypotonic and acid solutions of procaine hydrochloride, a somewhat slighter tissue reaction later in the operative field favored the borate. While these small differences indicated wherein the procaine borate appeared statistically to be somewhat more satisfactory than the hydrochloride, this would not necessarily hold for individual patients, nor justify claims of superiority in its behalf.

Against these apparent advantages were the nearly identical effects of the two solutions on blood pressure, pulse and respiration, and a definitely worse record for the borate in producing undesirable subjective symptoms. That is, there was a definitely increased amount of nervousness and perspiration with the borate, and about double the incidence of tremors and fainting. Some of these differences between the two solutions would not be detected in routine clinical use, since there is a much greater variation from patient to patient than there is between the two solutions; but it would seem that, in using procaine borate on a large series of patients, an operator would secure somewhat less undesirable aftereffects at the expense of a definitely higher incidence of reactions during the course of the operation. Procaine borate is more difficult to use than procaine hydrochloride, since solutions of it have to be made fresh and can be sterilized only with special precautions. Therefore, in the end, procaine borate offers no real or worth while advantages over procaine hydrochloride, owing to the greater difficulty of handling the agent and a greater incidence of immediate reactions.

CONCLUSIONS

1. The clinical local anesthetic efficiency of solutions of 2 per cent procaine hydrochloride and 4 per cent procaine borate (borocaine) was compared in a

series of 231 extraction cases, using a "blind test" procedure that eliminated subjective factors. The data were analyzed statistically to determine whether any differences observed were reliable or were the result of chance variation.

2. No differences between the two solutions were demonstrated in the volumes of anesthetic required or the times for anesthesia to develop or its duration.

3. The use of procaine borate produced complete anesthesia in 5 per cent more of the patients than did that of procaine hydrochloride, and its injection was painless in 9 per cent more than was injection of the hydrochloride.

4. There was a statistically unreliable indication that there was slightly less bleeding after the use of procaine borate than after use of hydrochloride.

5. The effects on blood pressure, pulse rate and respiratory rate from the two solutions were practically identical; both causing small average increases in pulse, respiration and systolic blood pressure and a slight fall in diastolic blood pressure.

6. There was a definitely greater incidence of systemic "reactions" with procaine borate; that is, perspiration, nervousness, tremors and fainting occurred almost twice as often as with procaine hydrochloride.

7. Although there were no differences in pain or inflammatory reaction at the site of injection, from use of the two solutions, the undesirable effects in the operative field were definitely less with procaine borate.

8. In view of the facts that solutions of procaine borate must be made fresh and can be sterilized only with special precautions and demonstrated only minor and practically negligible degrees of superiority, but definitely less desirable results as to immediate systemic reactions, as compared with those of procaine hydrochloride, procaine borate, at best, is no more desirable as a local anesthetic than is the commonly used procaine hydrochloride.

9. Since exactly isotonic and alkaline solutions of procaine borate were not found to be clearly superior to markedly hypotonic and strongly acid solutions of procaine hydrochloride, the factors of p_H and isotonicity seem to have been emphasized beyond their real importance in clinical local anesthesia.

BEHAVIOR OF AMALGAM AND THE TECHNIC OF ITS USE*

By GEORGE M. HOLLENBACK, D.D.S., Los Angeles, Calif.

THERE has been, for many years, a tendency to simplify and standardize all procedures in operative dentistry. This work, pioneered by Black, is almost universally accepted today. An attempt has also been made to standardize the various materials used in operative procedures, and the technic of their use. Through the efforts of a considerable number of operators, among whom might be mentioned Black, Wedelstaedt, Searle, Woodbury, Rule, Ferrier, Baird and Prime, gold foil technic has been very

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

thoroughly rationalized and standardized. Gold inlay technic, thanks to the efforts of Weinstein, Coleman, Scheu, the research workers in the United States Bureau of Standards and many others, has been robbed of most of its mysteries and difficulties and has been reduced to a point where it might be called a scientific procedure, without unduly distorting the facts of the case.

The work of Black, of about forty years ago, was the first done on amalgam that had a truly scientific basis, and on the findings and principles laid down at that time, all succeeding efforts along this line have been based. Credit should be given to C. M. McCauley, A. W. Gray, William E. Harper, Marcus L. Ward and a number of others for increasing the scope and the usefulness of the principles laid down by Black.

These efforts were not so generally accepted and understood that the manufacturers of amalgam alloys were induced to furnish the profession with suitable materials and to impress on its members the fact that, if satisfactory results were to be obtained in their use, they must be employed in a careful and exacting manner. To the Bureau of Standards, working in conjunction with the research department of the A.D.A., much credit is due for overcoming in large measure this situation. While it is probably true that most of the findings of the Bureau relative to dental amalgams were already known to a few persons, they were almost entirely unknown to the profession. But because of the Bureau's excellent work and the lucid and convincing manner in which its findings were presented, the subject has become more or less familiar to all of us. The information is available and we should all utilize it.

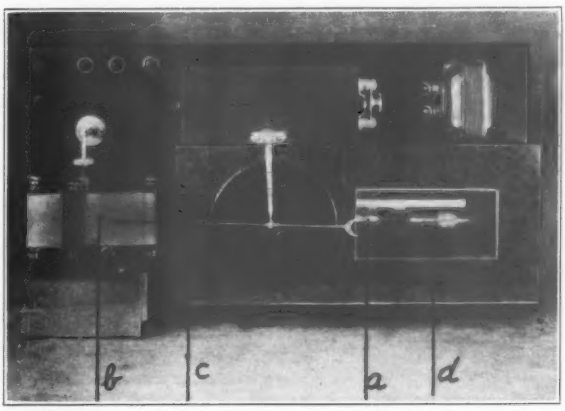


Fig. 1.—Electrically operated graphic recording instrument. By means of this instrument, any volume change in test specimen *a* is recorded on graph strip *b* by stylus *c*. The device is entirely automatic in operation and graphs may be made under controlled temperatures, as chamber *d* containing the test specimen is thermostatically controlled.

Having read various contributions to dental literature on the amalgam problem, and after carefully studying the chapters on amalgam in some of the more recent texts on operative dentistry, I am convinced that there is a need for further

enlargement on some of the phases of this subject. In a recently published text on operative dentistry, many pages are devoted to the physical properties and the technic used in the manipulation of amalgam. The instructions for combining the alloy with mercury are not at all specific and the statement is made that two minutes' trituration with mortar and pestle, followed with one minute of hand mulling, is necessary. As far as I have been able to determine, there is not an alloy on the market that will permit of this type of abuse, which will inevitably produce an overamalgamation and shrinkage of the mass. Also, nothing is

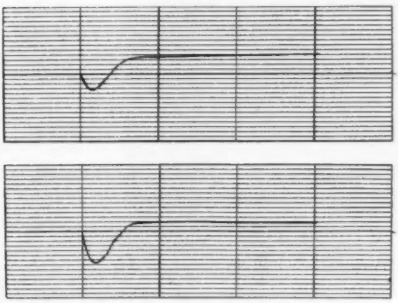


Fig. 2.—Two graphs made from test specimens of same alloy triturated and packed exactly in same manner. In the upper graph, the test was started fifteen minutes after the mix was started. In the lower graph, the test was started seven minutes after the mix. It will be seen that 2 microns of initial shrinkage was not recorded in the first specimen, though this shrinkage actually occurred. In these graphs, the heavy horizontal line is the base or zero point, from which all tests are started. Each line above this point represents 1 micron of expansion; each line below, 1 micron of shrinkage. Each vertical line represents the lapse of six hours.

said of the mortar and pestle, except that they be small and made of glass.

This seems to me to be a very serious omission.

Another text heads a paragraph as follows:

Shrinkage and expansion of the amalgam used is not under the control of manipulation by the operator.

It is true that a shrinking alloy cannot be made to expand by any modification in its use. It is also true that any expanding alloy can be easily manipulated in such a manner that it will show either its maximum expansion or a very serious shrinkage.

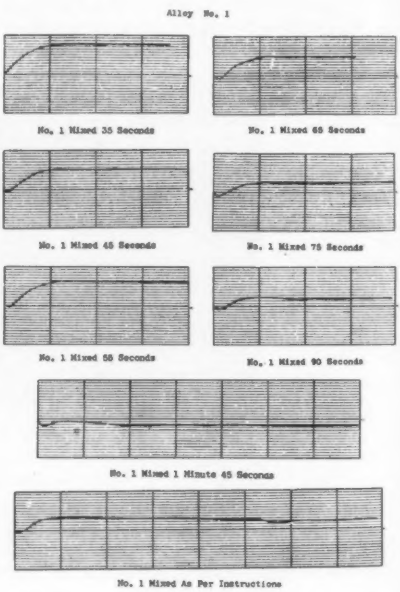

Alloy No. 1
No. 1 Mixed 35 Seconds
No. 1 Mixed 60 Seconds
No. 1 Mixed 45 Seconds
No. 1 Mixed 75 Seconds
No. 1 Mixed 55 Seconds
No. 1 Mixed 90 Seconds
No. 1 Mixed 1 Minute 45 Seconds
No. 1 Mixed As Per Instructions

Fig. 3.—Breakdown test made on popular make of alloy. It will be observed that this alloy has a comparatively long mixing range and that when mixed according to instructions, it gives a very satisfactory result. Considerable hand mulling is called for, which is considered objectionable.

I recently heard a most excellent paper read by a young man who has done considerable work with amalgam. I could make no criticism of his presentation ex-

cept this: He stated that the mix should be triturated for three minutes, then hand mulled, and while mention was made of the type of mortar to be used, it was not nearly so specific as it should have been. To cite one more instance of this kind: One of the finest operative dentists that I know made this comment when he examined some of my charts showing the effects of undermixing, correct mixing

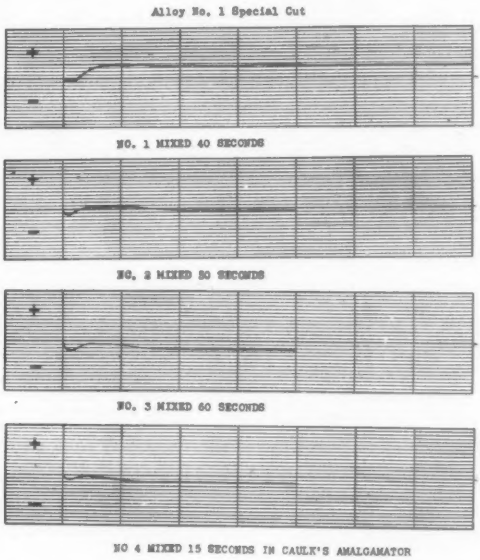

Alloy No. 1 Special Cut
NO. 1 MIXED 40 SECONDS
NO. 2 MIXED 30 SECONDS
NO. 3 MIXED 60 SECONDS
NO 4 MIXED 15 SECONDS IN CAULK'S AMALGAMATOR

Fig. 4.—Alloy No. 1, special cut. The only apparent difference between this alloy and the regular is that the cut is much finer. It will be noted that its behavior is greatly different, the mixing range being much shorter (less than ten seconds). The same instructions are furnished with both types of alloy, no recognition being made of their totally different behavior.

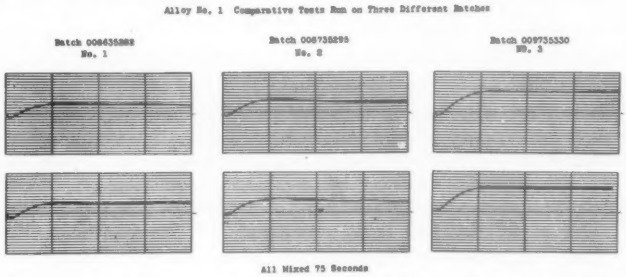


Fig. 5.—Tests made with three different batches of regular cut alloy No. 1. It will be noted that batches 1 and 2 showed almost exactly the same behavior, while batch 3 showed considerably more ultimate expansion.

and overmixing: "I am simply amazed to learn that so little trituration is required for the alloy that I have used for so many years and that the light pressure you advocate is sufficient. I always believed that heavy pressure and long mixing were desirable, and the more of it the better."

It is the general existence of beliefs such as this that prompted me to carry out a study of dental amalgams, and to report my findings. It is probably true that others know more of this subject than I do, but I am convinced that the rank and file of the profession do not possess this knowledge. I shall attempt to present some of my findings relative to the mixing of dental amalgam and the technic of packing or inserting it in the cavity. No attempt will be made to give findings relative to flow and tensile and ultimate crushing strength as the inclusion of these subjects would not be practicable and might be more or less confusing.

Every dentist who uses amalgam should be impressed with these two facts: 1. It is the duty of the manufacturer to make the alloy and furnish it to him in a suitable condition. 2. He himself must make the amalgam, and while it is entirely impossible for him to make a good amalgam with a poor alloy, it is very easy for him to make a poor amalgam with a very fine alloy, by incorrect manipulation.

The premise on which my work is

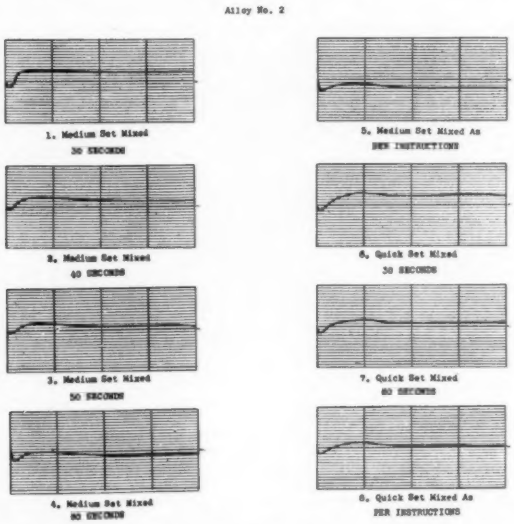


Fig. 6.—Breakdown tests on two specimens of alloy, one medium set, the other quick set. It will be observed that the specimens gave virtually the same result when subjected to a standard mixing process. When mixed according to instructions, the medium setting alloy shows 3 microns of ultimate shrinkage, while the quick setting is practically neutral. When correctly manipulated, this alloy should give a good result, but when manipulated according to the manufacturer's instructions, it is unfit for use. Its mixing range might be increased to advantage.

based is as follows: It would seem necessary, first, in combining amalgam alloys with mercury, that a certain type of mortar and pestle be adopted as standard. It was found that some types were 100 per cent more efficient than others. I, therefore, adopted a No. 8, which I found to be the most efficient. This was used in all tests that will be shown, unless otherwise specified.

Each specimen tested was purchased on the open market.

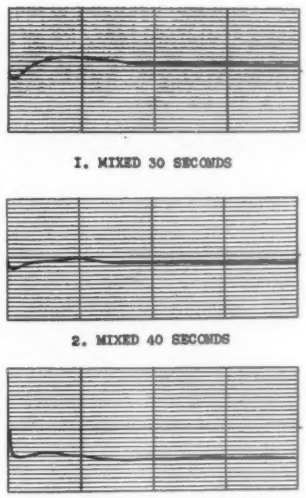


Fig. 7.—Alloy typical of number on market, showing approximately 1 micron of expansion even when triturated only thirty seconds. When mixed according to instructions, it shows a very great shrinkage.

METHOD OF TESTING

The proportions of alloy to mercury were secured by weighing, being those recommended by the manufacturer of each alloy tested. Twenty grains of alloy was adopted as a standard mix, this being a generous amount for packing the test die, which is 4.25 mm. in diameter and 1 cm. in length. The first test is made by triturating the mix until it becomes plastic, using a pressure of from 2 to 3 pounds on the pestle, which is held with a pen grip, with approximately 150 revolutions of the pestle per minute. With many alloys, satisfactory plasticity can be secured in thirty seconds. The amalgam is then removed from the mortar, placed in a small piece of rubber dam and worked into a compact mass, hand mulling being omitted, except in tests made according to instructions of the manufacturer that call for it. Reasons for omitting hand mulling will be given later.

Specimens are packed as follows: A small bit of amalgam is placed in the die and tamped to place with a steel rod 1 mm. smaller in diameter than the die, several thrusts of from 10 to 12 pounds being used. Excess mercury is removed and condensation completed with a flat-faced condenser, 2.5 mm. in diameter. The mass is carefully stepped, with a thrust of from 10 to 12 pounds. Another bit of amalgam is placed, from which a part of the free mercury has been expressed by pressing between thumb and finger. Condensation is secured as previously described. Each succeeding layer is built in a like manner until the cavity is seven-eighths filled. The free mercury is now removed from the remaining portion of the mix, which is added in small pieces to the filling until there is an excess. The excess is trimmed flush to the die and the test piece removed. It is now ready for insertion in the recording micrometer. (Fig. 1.)

All tests are begun exactly seven minutes from the time the mix is started. By working expeditiously, it is possible to do this, and, by so doing, early volume change in the test piece will be recorded. (Fig. 2.) With certain alloys, consid-

erable shrinkage is noted in the first few minutes. Each succeeding test is made by adding ten seconds to the mixing time, no other detail being changed to the slightest degree. Tests are made until the alloy is broken down, ultimately showing shrinkage. It will be readily understood that the mixing time will be established for each alloy; that is, which one gives the most desirable results will be determined. For instance, if desired, an ultimate expansion of 3 microns can be easily obtained, provided the given alloy has that wide an expansion range. In fact, any volume change within the range of the alloy may be secured. (Figs. 3-11.)

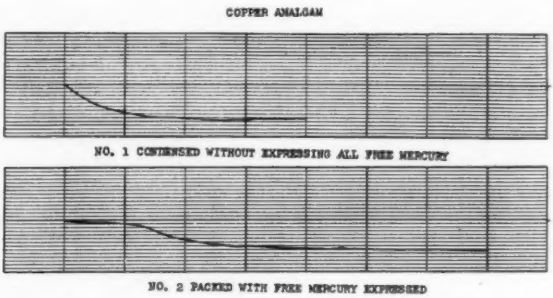


Fig. 8.—Behavior of copper amalgam. It has been determined that this material shrinks under all conditions. It is ordinarily regarded as neutral.

TECHNIC USED FOR CONDENSATION

As amalgam is a plastic material and, when correctly mixed, of a smooth, even texture, it would seem that its adaptation to cavity walls could be easily accomplished. The reverse is true, the process of condensation requiring a great deal of care and considerable skill if satisfactory results are to be secured. Every particle of the filling must be thoroughly condensed and the material must be carried to the cavity walls and forced against them in just as thorough a manner as when gold foil is used. Whenever this is neglected to the slightest degree, leakage and failure ensue. Considerable force is necessary, from 10 to 12 pounds being essential in large cavities where broad faced condensers are used. With smaller condensers, the force may be reduced in proportion to the area of the condenser.

All compound cavities must have matrices. Stainless steel 0.002 inch in thickness is recommended for this purpose. This is held in position by ligation with dental floss. The matrix is now securely luted to place with green modeling compound. By this method, the matrix is stabilized and will not move to the slightest degree even when heavy packing force is used. All types of matrices that yield as the filling is being inserted are unfit for use and cannot be too severely condemned. When the matrix has been placed, it should be moved slightly away from all cavity margins by the passing of a thin heated instrument between the margin and the matrix. This will soften the compound slightly, permitting the matrix to be moved away a few thousandths inch and allowing a slight excess over all margins, which is quite necessary. Proper condensation will separate the teeth sufficiently that, when the matrix is removed, a tight contact will re-

sult. It must be remembered that the thickness of the matrix material is only two-thousandths inch.

The toilet of the cavity is made by washing thoroughly with hydrogen peroxide followed by chloroform, care being taken not to touch the modeling compound, which is readily soluble in chloroform. Amalgam is prepared by weighing

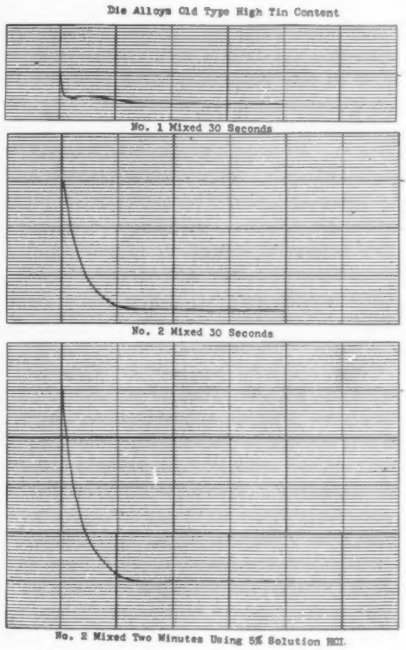


Fig. 9.—Results of tests on die alloys of high tin content. Their shrinkage varies from moderate to extreme. Acid solutions used to facilitate amalgamation tend to increase shrinkage and to render close adaptation very difficult or entirely impossible. This is caused by the impossibility of completely eliminating moisture from the mix. Alloys of this type are unfit for use.

alloy and mercury and mixing them in correct proportions, as previously described. From thirty seconds to two minutes will be required, according to make of alloy used. Hand mulling is condemned for the following reasons: 1. It is entirely unnecessary. 2. Perspiration is liable to be mixed with amalgam, and only a very small amount of moisture will prevent complete adaptation of amalgam to the cavity walls. 3. Desquamated epithelium, sebaceous fluid, bacteria and other foreign matter will be incorporated with the amalgam, which is an unthinkable thing in a surgical procedure; and

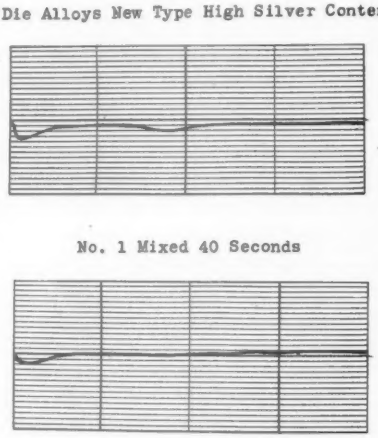


Fig. 10.—Tests on newer type of high-silver-content die alloys. These alloys are proved to be practically neutral and are therefore ideal for the work for which they are intended.

the filling of a cavity with amalgam comes under this classification. Packing is done as previously described, with these exceptions: The filling is very carefully stepped along the cavity walls with a small condenser. After each layer has been condensed and free mercury largely removed with a large condenser, final adaptation is secured by spinning amal-

gam against the cavity walls, a very small ball burnisher being used with very light pressure. A little free mercury should always be left on the surface of each layer to secure perfect adhesion of the next layer. When the cavity is approximately seven-eighths filled, the free mercury is removed from the residue of the mix, which is added in small pieces to the filling and thoroughly condensed. Enough free mercury will be absorbed from the filling to render this dry material plastic.

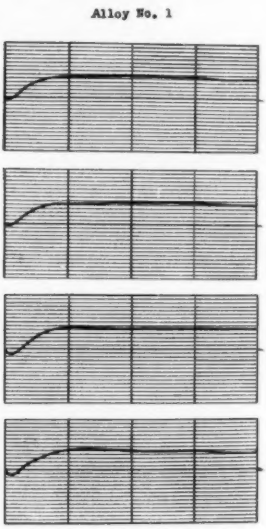


Fig. 11.—Results of four tests with alloy No. 1, using a No. 8 mortar and pestle. The pressure on the pestle and its alinement are mechanically controlled. Three of these tests gave almost exactly the same result. The fourth one shows 1 micron less of ultimate expansion.

The filling is now built to excess to absorb any remaining free mercury. It must be remembered that as considerable time is required in making a good amalgam filling, quick setting amalgam should not be used, particularly in complex restorations. Some have stated that the maximum working time for amalgam is two minutes. If I believed this to be true, I would not use amalgam, as even a large Class 1 cavity cannot be correctly filled in this time, and the more complex the cavity, the more time required. If an amalgam is used that is not too quick setting and the free mercury is allowed to remain until it is used, it will be found to remain in good working conditions for several minutes. Carving should not be undertaken until the amalgam has started to set.

CONCLUSION

The manufacturer's instructions, given with all the alloys that I have tested, are in all cases not sufficiently explicit, and many are so absolutely wrong that an otherwise good alloy will be completely ruined when amalgamated according to the manufacturer's instructions. I believe that several new specifications should be added to those already prescribed by the Bureau, and some of the existing specifications should be changed. 1. A specification should be set up relative to setting time, as from four to six minutes is usually required to make a satisfactory amalgam filling. The setting time should equal or exceed these limits. 2. Detailed and adequate instructions for mixing should be required from each manufacturer. 3. The mixing range of each alloy should be established and stated by the manufacturer. If a given alloy has too close a mixing range, it is not suitable for use, as care and precision beyond that possessed by the average person would be required. 4. A specification should be set up relative to the time allowable for initial contraction. It seems only reasonable that an amalgam which contracts from 4 to 6 microns or more,

and remains so contracted for a considerable length of time, from two to three hours or more, is obviously not desirable, even if the ultimate expansion equals or exceeds that required by the specification. 5. The specification relative to the initial shrinkage should be changed, as follows: Initial shrinkage shall not exceed 4 microns. These specifications are not unreasonable, as several alloys now on the market meet them adequately. As for instructions, it would be an easy matter for all manufacturers to provide those which are adequate in every way.

All mechanical mixing devices that I have tested have proved inefficient and disappointing, and I cannot recommend that any of them be used. Also, I consider distinctly dangerous all use of chemical compounds to hasten amalgamation. To date, a suitable mortar and pestle in the hands of a trained operator are the best means available. In my opinion, the best solution would be a device whereby the pressure on and alinement of the pestle would be mechanically controlled. Under these conditions, a given number of revolutions of the pestle should give a constant result. I have made an experimental device of this kind and results so far secured are encouraging. (Fig. 11.)

DRUGS—THEIR USE AND ABUSE*

By JOHN E. GURLEY, D.D.S., F.A.C.D., San Francisco, Calif.

THE late William Henry Welch, of Johns Hopkins University, was one of a small group who exerted a profound influence over the medical profession, and those interested in sciences related to medicine. His characteristics and his virtues have been vividly portrayed,[1] but, back of these, there seems to have been something which, like a growing plant, burst into full bloom in him. He came from a long line of physicians, his father, being considered by the "old citizens of Norfolk," as the most famous. He was known as " a beloved practitioner." To him, his son, William Henry, erected a fountain, carrying the legend, "Fons sum solati, talis et ipse fuit—I am the fountain of comfort, as he was himself." What a splendid compliment to be paid by one man to another, even a son to a father!

Back of everything man may think or do, and back of everything he says, is the principle expressed, or unexpressed, of comfort. Especially is it true of, or, at least, it is the charge upon, us, as professional men, to bring comfort to those whom we serve. One of the channels through which we may bring that comfort is the proper use of drugs.

It is well to discuss the use and, incidentally, the abuse of drugs, for if we know the use, consideration of abuse becomes unnecessary, save as a warning, which, in some instances, may prove of value.

To the Council on Dental Therapeutics, of the American Dental Association, we owe a great debt of gratitude for work

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

1. Riesman, David: William Henry Welch, Scientist and Humorist, Scient. Monthly, p. 251.

already done. The effort now being expended, both in clearing up our rather careless methods of practice in drug application, and in stimulating our members to a more aggressive and progressive effort in this line, marks one of the high advances of organized dentistry. That our literature now carries many articles on the subject of drugs indicates clearly the upward trend in our thinking and in our practice.

The accompanying chart presents a proposed analysis or outline of the practice of dentistry, with the application of drugs to the conduct of the specialties.

With this picture of dentistry before us, the classification and application of drugs becomes less difficult to understand. With such a picture, too, the relation between the various types of work that we are called on to do becomes more obvious. Just as surgery is a branch, and not a specialty, of medicine, so in dentistry, oral surgery should be a branch, or division, of the parent profession. Exdontia is a specialty of oral surgery, a division of dental practice, as orthopedic surgery, for example, is a specialty of surgery, a division of medical practice.

USE OF DRUGS[2]; CLASSIFICATION

Drugs may be classified according to their use in the practice of dentistry (1) to diagnose disease; (2) to prevent disease; (3) to cure disease (cure meaning discovery of disease and removal of cause and effect), and (4) to alleviate symptoms.

Drugs may also be classified as to whether they are to be administered internally or applied locally.

On occasion, we use drugs for diagnostic purposes, particularly in conjunction with roentgenography. A radiopaque substance may be placed in the canal of a tooth or injected into an area to be roentgenographed. Bismuth paste is used for the purpose, and may be injected into a fistulous tract.[3] A guttapercha point or a steel wire may be used in the root canal.

Those drugs used in the prevention or cure of disease are disinfectants, which destroy both the organism and the pabulum on which it lives; germicides, which destroy the germ, but not the pabulum, and antiseptics, agents which keep a clean area clean.

Those drugs used to alleviate symptoms are called analgesics and hypnotics. Again, the use of drugs from a dental standpoint may be for premedication or postmedication. Classification might be carried further; but this, no doubt, includes those drugs which come within the scope of dentistry.

In the application of drugs, whether locally or internally (orally, rectally, intramuscularly, intravenously or by inhalation), the action on human tissue should be given careful consideration that the operator may be forewarned should any untoward result obtain. This study of the action of drugs on human tissue, as a means of combating ill-effects and, especially, that one may know how results, good or bad, are obtained, is accomplished through that branch of science known as pharmacology, which may be defined as "the science of the nature and properties of drugs."[4] Applied pharmacology means "the study of the action of drugs on living tissues."[5]

In the selection of drugs, there is always at hand, and authoritative, without any interest other than scientific truth, the

2. Leake, C. D.: University of California Extension Lectures in Pharmacology, Fall and Winter, 1934-1935.

3. Raper, H. R.: Elementary and Dental Radiography, New York: Consolidated Dental Manufacturing Co., 1913, p. 199.

4. Gould's Medical Dictionary.

5. Clarke, A. J.: Applied Pharmacology, Philadelphia: P. Blakiston's Son & Co., 1933, p. 1.

United States Pharmacopeia, National Formulary, New and Nonofficial Remedies (N.N.R.), of the American Medical Association, and Accepted Dental Remedies (A.D.R.), of the American Dental Association. Judgment should dictate constant reference to one or more of these. Facts, as far as they are known, are thus available and, incidentally, it is possible to secure drugs at a much lower cost with this information.

Operative Dentistry

In operative dentistry, caries and cavity preparation may, at times, call for the use of drugs. In consideration of such products as vitamins, ergosterol, glandular secretions, calcium and calcium-phosphorus combinations, which may be administered as an aid in calcium deposition, we, as dentists, should proceed slowly. Complications are liable to enter, as they have in the use of ergosterol, or even cod-liver oil, and hence it is best to consult a physician. So-called "calcium deficiency" is not yet fully understood.

In cavity preparation, the need for alleviation of pain is omnipresent. It may be well to sound a word of warning: In a paper read by Paul H. Jeserich, of Detroit, before the First District Society of New York,[6] is found a real answer to the pain problem, in technic. Those who have taken graduate work recently in a dental school, and have a knowledge of the lighter and sharper instruments, together with an improved technic in their manipulation, will find that Dr. Jeserich is scientifically and technically correct. Students are being taught this, and if we don't take care, they will crowd us out at an earlier age than we crowded out the generation ahead of us.

As to the drug, or drugs, that may relieve pain in cavity preparation, procaine is the only dependable one. Occasionally, for some reason, this may fail; when resort can be had to general anesthesia. Between local and general anesthesia, and closely related to the latter, is so-called analgesia, an early stage of anesthesia. This is usually produced by the use of nitrous oxide and oxygen, but it has not been proved wholly effective. Each generation, it seems, has to go through similar cycles of selling, and so now manufacturers are trying again to sell gas machines to the profession for this purpose. The pharmacologic action of these need not be considered here. They should be left to anesthetists.

An analgesic relieves pain by its action on nerve tissue, directly, in topical application; locally, as in local anesthesia, or basally, as in analgesia, narcosis or general anesthesia. The action may be destructive, as in the use of coagulants, or it may be by paralysis of the cells, thus inhibiting normal functional processes, as in the use of inhalants, local anesthetics or drugs, internally administered, such as barbital or one of the phenol derivatives. Sometimes, plain cold water or cold salt solution will have an analgesic effect, due to temperature reduction, followed by brief paralysis. Analgesia is, at any time, an early stage of anesthesia, and narcosis is a slightly deeper stage than analgesia.

While there is no nerve tissue in the dentin, the dentinal fibrils are extremely responsive to irritation, and pain is the result.

Agents used as pain reducers in cavity preparation may then be classified as: (1) inhalant: nitrous oxide-oxygen (unsatisfactory); (2) local anesthetic: procaine (satisfactory), and (3) that internally administered. Internal administration may be accomplished in any one of three ways: by injection, rectally or orally. Here, oral administration only is considered.

6. Jeserich, P. H.: New York J. Dent., 5: 275 (Dec.) 1935.

There are four classes of these drugs, all of which will produce complete anesthesia, if given in sufficiently large doses, but which are, for various reasons, unsuitable for this purpose in clinical practice, and hence are used in smaller, or normal, doses for specific purposes.[7] A narcotic is an agent which produces a state of complete unconsciousness. A hypnotic is an agent which induces sleep. A sedative is an agent which allays nervous excitement. The relation between these is relative. The use of a narcotic will assure all three results; a hypnotic, the second and third; while a sedative has but the one action. Overdoses of a hypnotic or a sedative will bring about narcosis, but perhaps with tragic complications.

FORM CLASSES OF DRUGS

1. *Aliphatic Narcotics.*[8]—The aliphatic narcotics are derived from fatty acids, and other hydrocarbons, the paraffin, ethylene and acetylene series. Some of the more common are ethyl alcohol, CH_3CH_2OH, avertin (tribromethyl alcohol, CBr_3CH_2OH), paraldehyde, chloral hydrate, sulphonal and barbital.

The barbitals are heralded very widely at the present moment, in that their chemical structure is such as to permit of an infinite number of substitution products, and so the market is flooded. In their use lies the best argument for pharmacologic instructions from that source which has no interest other than presentation of the truth. There are two sources to which appeal can be made: departments of pharmacology of the universities or the Council on Dental Therapeutics. Of the great number known to science, the great number marketed under various names, but two are at present recommended for the purpose of dental practice: barbital-sodium (soluble) and phenobarbital.[9] To these, Leake[10] would add sodium iso-amylethyl barbiturate (sodium amytal) and sodium ethylmethylbutyl barbiturate, pentobarbital sodium (nembutal). Sodium amytal and nembutal, though trade names, are listed in N.N.R., and may be accepted professionally.

There is a large number (1,225)[11] of these barbitals, or barbitone homologs, containing not more than six carbon atoms in a single chain. They vary greatly in value as to use, but are used more and more extensively as hypnotics and for premedication for general and local anesthesia.

Sodium amytal and nembutal break down rapidly in the body.[12] They can be given in full doses. (Sodium amytal, 0.2 grains, can be repeated in six hours if necessary, but should be used only by those who have had much experience.) Nembutal[13] produces narcosis lasting only a few hours. One is warned against administering these drugs unless thoroughly familiar with the literature concerning them.

The market is loaded with various narcotics and combinations of narcotics. Much experimentation has been carried on in an effort to determine the value of these combinations. It has been determined that not only are they of no value, but also they may be dangerous, in that the dosage requirement of each is difficult to maintain. The most valuable combination, if such it may be called, lies in the use of a hypnotic (phenobarbital 1-1½

7. Clarke, A. J.: Applied Pharmacology, p. 185.

8. Footnote 7, pp. 184-207.

9. A.D.R., 1935, pp. 60-61.

10. Leake, C. D.: Personal communication to author.

11. Footnote 7, p. 189.

12. Footnote 7, p. 176. Hanzlik, P. J.: Agranulocytosis: Critical Review of Causes and Treatment, Historical and General, J.A.D. A., 22:487 (March) 1935.

13. N.N.R., 1934, pp. 96 and 102.

grains or barbital $\frac{5}{8}$ grain) previous to administration of a volatile anesthetic; in which case, anesthesia can be more easily attained, and any ill after-effects are greatly reduced.

2. *Analgesics: The Opium Alkaloids.*—These consist of morphine and opium and their derivatives. They will not be considered in this instance.

3. *Depressants of Motor Function: The Bromides.*—The bromides, as a class, have a definite therapeutic use in medical practice, but are not necessary in dental practice.

4. *Aromatic Analgesics.*—These are phenol derivatives having a common action in reducing temperature and aches and pains. The one most widely known and most commonly used is acetylsalicylic acid (aspirin). It is said that "tens of thousands of tons of this drug are used annually," chiefly, perhaps, for headache, and, more often than not, for toothache. Other drugs of this class are cinchophen, phenacetin and antipyrin. These have been largely replaced by acetylsalicylic acid and a derivative of antipyrin, pyramidon, which, on account of the possibility of its use being the cause of agranulocytosis, should, for the present at least, not be used.

These drugs are all known as basal narcotics. They will give relief from pain, but their action as analgesics in cavity preparation is not only doubtful, but actually negligible.

TOPICAL ANESTHETICS (DENTIN DESENSITIZERS)

Among the topical anesthetics may be named phenol and phenol derivatives, the chief of which are eugenol and thymol. These come within that group previously indicated as destructive. Phenol coagulates protein tissue. It is known as a self-limiting drug, but as it destroys layer upon layer, it may, to that extent, allay pain in cavity preparation. It has been used for many years, with moderate success.

Thymol, a derivative, has a disinfectant action twenty-five times that of phenol. It likewise coagulates protein tissue. Because of tissue destruction, the response to pain is lessened to a limited degree. Attempts have been made to find agents which will carry it more deeply into the tooth, but the results have been no more satisfactory than with other solutions. Eugenol penetrates deeply into the dentinal tubules, and, like others, has its recorded successes.

A formula for a topical anesthetic in which benzocaine is the active agent has been used, and Prinz[14] suggests practically the same formula minus the benzocaine. Many formulas have been presented, and many drugs have been tried, some of which have met with fair results. Benzocaine is inefficient in its application to the soft tissues, owing to its inability to penetrate unbroken mucous membrane.[15]

Drugs have been introduced that may be sealed in the tooth for from twenty-four hours to forty-eight hours. They are dangerous to use in that death of the pulp may result. Some form of formalin is the active agent, and, from its action in precipitating protein, its use results in death of the pulp. These preparations should not be used.

Successful painless cavity preparation is accomplished through complete anesthesia, either general or local. The

14. Prinz, Hermann: Dental Formulary, Ed. 5, Philadelphia: Lea & Febiger, 1936, p. 192.

15. A.D.R., 1935, p. 49. Tainter, M. L., and Moose, S. M.: Studies in Topical Anesthesia. I Efficacy of Certain Common Anesthetics When Used on Gums, J.A.D.A., 23:244 (Feb.) 1936; Practical Value and Limitations of Topical Anesthesia in Oral Surgery, ibid., 23: 309 (Feb.) 1936.

former is not desirable for many reasons and is therefore not extensively used. The latter, local anesthesia, is the choice *par excellence*. But even this has its dangers, the chief of which is too extensive cavity preparation, with the consequent too great bulk of filling material and subsequent pulp irritation. It is better to use sharp instruments, deftly applied, and prepare shallow cavities which require the smallest possible quantity of filling material. The life of the pulp is thus greatly enhanced.

In the opening and filling of root canals, the following drugs and chemicals are not only useful, but also necessary: In case fragments of the pulp, connective tissue, remain, a thorough washing with concentrated sodium hydroxide will remove this tissue, by changing it in part to soap. Then, by the addition of water, the canal may be cleansed. Phenol sulphonic acid[16] may be used in conjunction with files to enlarge the canals. In its action on the calcium salts of dentin, soluble calcium salts are formed, which, by the use of water, can be easily removed. This should be followed by a free application of sodium bicarbonate, neutralizing all of the acid, and washed again with water, and the canals dried. Thus, the canal is prepared for filling. This is to be done in permanent teeth only.

Oral Medicine

In oral medicine, there is greater need for drug therapy, for here we are dealing generally with disease conditions.

1. *Vital Pulps.*—(*a*) Active hyperemia: In this, a sedative dressing is indicated, and any one of the following may be used: oil of cloves, phenol or creosote (H. & H.), the principal requirement being the exclusion of air. The action of these will be subsequently discussed.

16. Footnote 14, p. 182.

(*b*) Passive hyperemia: A sedative dressing may prove beneficial for a time, but devitalization is ultimately required. For this purpose, resort may be had to one of the following:

1. Arsenic, which has been used extensively, and is now used moderately, and still is the best, easiest and safest means of pulp destruction in deciduous teeth. It is a strong caustic, being rapidly absorbed by the tissues. It therefore kills by strangulation. It should be used in minimum dose.

2. Cocaine, which is sometimes used in what is termed pressure anesthesia. It paralyzes nerve fiber.

3. Procaine (novocaine), which is used hypodermically. It also paralyzes nerve fiber.

(*c*) Exposure of pulp: In selected cases, the pulp may be capped or covered, the following formula having proved successful: liquid: menthol, 2.6 parts; thymol, 5.2; phenol, 24.0; powder: calcium phosphate, 36 parts, thymol 6.

(*d*) Hypertrophy of pulp: The pulps are easily removed by repeated applications of phenol, the action of which has been previously discussed.

2. *Diseased Pulps.*—Partial or complete gangrene and alveolar abscess come within the same general line of treatment, requiring, in the beginning, a disinfectant. There are a number, any one of which may give satisfactory results. It is not intended to discuss a possible line of treatment, but to present a list of drugs, with their pharmacologic action. One may develop his own technic in treatment. The important thing is to get results, and to know why and how.

(*a*) Cresolated formaldehyde[17] (formula derived from the National Formu-

17. Gurley, J. E.: Indications, Contraindications and Technic in the Treatment of Infected Deciduous Root Canals, J.A.D.A., 23: 113 (Jan.) 1936.

lary: beechwood creosote, or cresol, 5 c.c., formaldehyde, 40 per cent, 3 c.c., absolute alcohol, 2 c.c.): Formalin, the active agent, is a powerful disinfectant, but it is a sure one, and doubly so because it is a gas, and will thus reach the uttermost parts of the canal. If it is left in the tooth no longer than twenty-four hours, the operator will be well within the limits of safety. Care must always be exercised not to overtreat or to injure with strong drugs.

The cresolated formaldehyde may be prepared by the druggist and renewed quite often. Drugs must be fresh. Cresol may be substituted for creosote. It is well to have both, for different people react differently to drugs.

Formalin precipitates proteins in a manner not unlike the precipitation of egg albumin when heated. It will, under proper conditions, react with ammonia to form hexamine. Therefore, it will have this tendency within the tooth and the gaseous end-products may thus be reduced. If allowed to remain too long, and in excess over diseased proteins, it destroys healthy protein beyond the apex; hence, the need for care. This is chemistry, and the law of definite proportion is definitely applicable. The cresol, or creosote, though possessing bactericidal properties, is a vehicle for the formalin. Alcohol, with some disinfectant qualities, merely clears the solution.

Creosote possesses anesthetic properties and is a mild disinfectant. It is a coagulant like phenol, but, unlike phenol, its disinfectant action is not interfered with by the coagulated tissue. Care should be exercised to select clear, colorless creosote, which will not discolor the tooth.

(*b*) Chlorothymol (chloral hydrate and thymol, equal parts, with alcohol in sufficient quantity to keep liquid): Chlorothymol, introduced by Grove, has a very useful place in the treatment of infections. Thymol, as a disinfectant, has a phenol coefficient of 25. It is a powerful disinfectant, both as a liquid and through vapor given off. It easily penetrates the tubuli, and thus carries its action into the deeper parts.

Chloral hydrate is a hypnotic, pharmacologically, and is used in this case as a vehicle for thymol. The function of alcohol is that of a solvent and vehicular.

(*c*) Creosote[18] (H. & H.): This has been discussed above.

(*d*) Camphorated phenol (Prinz) (phenol [crystals], 2 parts; camphor, 4; liquid petrolatum, 4): Phenol has been previously discussed. Camphor is much used hypodermically as a circulatory stimulant. Its action is indirect, as it is primarily a sensory nerve stimulant. It may aid in increasing the circulation about the tooth, thus assisting in breaking down infection.

(*e*) Guaiacol: This, like other phenols, is a germicide. It acts by coagulation of protein, and may have a place in the treatment of infections.

3. *The Investing Tissues.*—The entire gamut of investing tissue diseases, from simple gingivitis to parodontosis, may be grouped together in this consideration. The most important therapeutic agent is instrumentation. The next most important consideration is that the tissues shall be so treated, both by instruments and by drugs, that nature can carry out her own repair. Drugs do not repair—they merely help. Clarke says,[19]

> The natural power of the tissues to produce bactericidal substances and the power of leucocytes to destroy bacteria are the most important factors in producing the healing of infected wounds, and also in preventing the spread of bacteria from infected wounds into other tissues. No antiseptic can act as an efficient substitute for these processes, and, therefore, any wound

18. A.D.R., 1935, pp. 155-156.

19. Footnote 7, p. 43.

antiseptic must supplement, and not hinder, these natural processes.

Phenol and drugs of that type are, therefore, eliminated.

Iodine, which is used in dental practice extensively, ranks high among disinfectants. Iodine, an irritant, precipitates proteins; therefore, it should be used carefully on broken mucous membranes. While it may be true that the water-soluble preparations have no especial advantage over the tinctures, Sollman[20] suggests that the presence of potassium iodide renders the solution less irritant, and much less precipitant to proteins, than the simple alcoholic tinctures, or the secret and nonsecret "miscible tinctures." The simple alcoholic solution may be best for disinfection of an unbroken surface; while the U.S.P. solution may be superior for disinfection of open wounds. The former precipitates proteins, while the latter does not; hence, in its use, there is less interference with tissue repair.

An aqueous solution of iodine, official in the U.S.P., known as Lugol's solution, is composed of iodine crystals, 5 parts; potassium iodide, 10; distilled water to make 100.

Prinz[21] gives a number of water-soluble iodine solutions, substituting the zinc salt for potassium and adding glycerine. It is not known whether the zinc salt is of any value. It has been eliminated from the U.S.P.[22] Iodine is soluble in a solution of zinc iodide, as it is in potassium iodide. Glycerine is hygroscopic and acts as a dehydrating agent, thus relieving inflammation. On account of its viscosity, it helps to retain any antiseptic agent.[23] The use of glycerine as a vehicle for drugs in dental practice must, and will, undergo further experimentation.

20. A.D.R., 1935, p. 126.
21. Footnote 14, p. 175.
22. A.D.R., 1935, p. 171.
23. Footnote 7, p. 40.

Drugs possess a definite selective action on cells; hence, it is possible to select a certain drug for a particular use. This fact has already been brought out to some extent, but, in further consideration, the value of brilliant green is greatly reduced in the presence of serum, while that of acriflavine is increased.[24] The same is true with regard to protein. Bacteria are protein in type, and drugs that precipitate protein will, if protein is present, attack it first, leaving the bacteria unharmed.[25] Protein-precipitating drugs may thus become valueless.

Other satisfactory disinfectants are certain of the coal-tar derivatives; brilliant green, crystal violet (1:500 or 1:2000) or violet green (a mixture of the two), 1 per cent in 50 per cent alcohol, and acriflavine (1:1,000) in physiologic sodium chloride solution.

These are all coal tar dyes of the methane group, carrying the triphenyl radical. Brilliant green is probably the most powerful, having a phenol coefficient of 40,000 in aqueous solution, as tested on *Staphylococcus aureus* (Browning). At the same time, the presence of 10 per cent serum reduces its efficiency to about 0.3 per cent of that value.[26] However, it still ranks high.

Acriflavine shows a phenol coefficient of 80 in water; but, in 10 per cent serum, it rises to 800. Acriflavine is soothing to the tissue and thus should enjoy a wide use in dental practice. It is best used in 1:1,000 physiologic sodium chloride solution. It is an excellent disinfectant, as just indicated; is soothing and healing to the soft tissue after scaling, and will serve as a disclosing solution in prophylactic treatment. It was first introduced into

24. Footnote 7, p. 29.
25. Beckwith, T. D.: Germicides and Dentists, J. South. California D. A., April, 1936, p. 729.
26. Footnote 7, p. 29.

medical practice as an internal antiseptic, but it was too irritating for that purpose, and hence did not appeal to the dental profession, nor to the medical profession, for external use. To repeat: Under normal conditions, it has a phenol coefficient of 80, its value increasing in the presence of blood. For this reason, it really surpasses in value any dye that we now use.

A mixture of the two dyes brilliant green and crystal violet, called viogen, finds a wide field of application.

Vincent's infection, one of the soft tissue diseases, should be considered separately. At the outset, let it be understood that it should be treated by the dentist. Drugs finding usefulness in its treatment are viogen, applied locally; sodium perborate, applied locally, and/or used as a mouthwash; and solution of potassium arsenite U.S.P. (Fowler's solution).

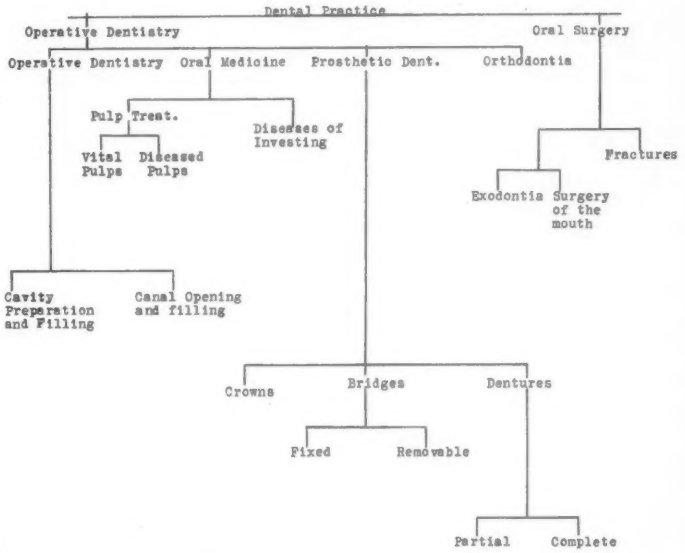
Musberger[27] has presented a review of many different drugs used in the treatment of this disease. Among others are mentioned chromium trioxide and chromic acid. These are ultimately the same thing, for, in the presence of moisture, the trioxide CrO_3 becomes chromic acid (H_2CrO_4). A 7 per cent solution of this acid is used in conjunction with hydrogen peroxide.

The pharmacologic action of most of these drugs has been previously discussed. Chromium belongs to the arsenic group. Chromium trioxide, or chromic acid, is a strong caustic. Great care must be exercised that the deeper parts, including bone, are not injured.

Hydrogen peroxide has a limited use in the practice of dentistry. The chief value of this agent is due to the libera-

27. Musberger, L. E.: D. Cosmos, 70:1029 (Oct.) 1928.

THE PRACTICE OF DENTISTRY IN OUTLINE



tion of nascent oxygen, and it is useful in suppurating wounds because of the mechanical action of the gas liberated in loosening and removing particles of pus. It has little germicidal value, because of its action on protein tissue, precipitating protein.

Sodium perborate is used for reasons similar to those just enumerated for hydrogen peroxide. In the presence of purulent sores, it has value through this nascent oxygen. It may have an advantage over hydrogen peroxide in that it yields an alkaline solution.[28] Improper or too extensive use may give rise to "chemical burns."[29] There is much debate as to the propriety of its regular use as a dentifrice.[30] The Council on Dental Therapeutics does not accept dentifrices containing it.[31]

Prosthetic Dentistry

The drugs indicated in prosthetic dentistry are the same as those described heretofore. It should ever be the dentist's aim to accomplish his work with a minimum of discomfort to his patient. Hence, the use of those agents that reduce pain in cavity preparation should assure the same result in the preparation of teeth for crowns and partial dentures. Prevention of gagging in impression taking is often a requirement. Painting the soft tissues with camphorated phenol, previously discussed, will meet the demand.

Orthodontia

The orthodontist probably least of all dental specialists has need for drugs. In case they may be required, suitable agents may be found among those here described.

Oral Surgery

In oral surgery is found an extensive use for drugs. Many of those previously described have application here. The list may be extended to include:

Aromatic spirits of ammonia, a "respiratory and cardiac stimulant, which acts quickly and is preferable to any form of alcohol in that it has no depressant after-effect. It may be administered by inhalation of the gas liberated from ammonia water, or internally as well-diluted aromatic spirits of ammonia.

Trichloracetic acid, which finds a limited use in oral surgery and dental practice. It is an escharotic, and as such may be used in removal of remnants of tissue, or as a hemostatic. It must be used with extreme care since it will spread over a wide area.

Drugs used in premedication, which have been previously discussed, consist largely of the barbitals.

Postmedication consists largely in treatment of (1) the socket after extraction, (2) postoperative pain and (3) dry socket. Here, again, an analgesic, acetylsalicylic acid or a barbital, may be used, or the socket may be packed. Such a packing may be compounded of zinc oxide and powdered rosin, equal parts, mixed with a liquid composed of eugenol, 1 part, and heavy mineral oil, 3 parts. This is also used after operation in pyorrhea. (Crane and Kaplan.[32])

Miscellaneous Drugs

Application of a topical anesthetic to the gums at the time of scaling or just

28. A.D.R., 1935, p. 147.

29. Hirschfeld, Isador: Vincent's Infection in Mouth: Clinical Incidents of Diagnosis and Treatment, J.A.D.A., 21:776 (May) 1934.

30. Voorhies, F. H.: Sodium Perborate Not a Dentifrice, Chicago D. Soc. Bull., 16:19 (Sept. 5) 1935; Sodium Perborate Still an Unstable Product, ibid., 16:11 (March 19) 1936.

31. A.D.R., 1935, p. 147.

32. Crane, A. B., and Kaplan, Harry: Crane-Kaplan Operation for Prompt Elimination of Pyorrhea Alveolaris, D. Cosmos, 73:643 (July) 1931.

prior to the adjustment of the rubber dam gives some relief. The following may be used: phenol, 0.5 part, procaine, 0.5, menthol, 1.25 parts and petrolatum alba, 24; made into a paste (formula of Prinz[33]).

In the filling of root canals of deciduous teeth, any paste or substance which disappears as the root is resorbed may be used. A good one is composed of bismuth tribromophenate, 2.5 gm., zinc oxide, 7.5 gm., phenol, 15 minims, and glycerine, to make a paste.

Xylene is very useful in removing guttapercha points from root canals, being a quick solvent for guttapercha.

Acetone is a good rosin solvent for use in preparing a rosin solution for root-canal filling. This very thin solution may be kept in the canal for a few moments, during which time the rosin is carried into the tubuli, which are thus sealed before insertion of chlorapercha and guttapercha points.

As a disinfectant, or even an antiseptic, in root-canal treatment, Black's 1-2-3 mixture is not out of date and is often useful. It is composed of oil of cinnamon, 1 part, phenol, 2, oil of wintergreen, 3.

A cavity varnish (lining) consists of copal, 5 parts, and ether, 100.

Absolute alcohol is useful about the office, the medicated being satisfactory. It neutralizes phenol and should be applied if phenol be dropped on the face or hands. Reduced to 70 per cent strength, it is a fair disinfectant. Owing to its affinity for water, it is an excellent dehydrating agent.

Sodium chloride tablets are handy in preparing sodium chloride solution for a mouth wash or spray.

Ringer's solution is the vehicle for procaine, if the dentist prepares his own solution.

Wood or denatured (methyl) alcohol is useful if an alcohol lamp is used for heat.

Dobell's solution is useful as a mouth wash, and also in solution to keep saliva tubes clean after boiling. A teaspoonful is used to a glass of water. According to the U.S.P. formula, it consists of sodium borate, 5 parts, sodium bicarbonate, 5, phenol, liquid, 1, glycerine, 10, and water to make 31.25.

Zinc chloride finds use in the dental office as a liquid combined with zinc oxide powder to prepare zinc chloride cement for sealing the orifices of root canals in permanent teeth after filling. It may be used to paint the exposed necks of teeth to relieve sensitiveness. In this, it is coagulant.

A good preparation for the cleaning and oiling of handpieces is as follows[34]: oil of bergamot, 80 drops, methyl salicylate, 160, compound solution of cresol, 320, light machine oil, 480, and benzene to make 16 fluid ounces.

Zinc oxide finds a use in conjunction with zinc chloride, as indicated above, in forming the cement. It is useful in many other ways and is the base of the regularly used cements. It is used in conjunction with oil of cloves as a temporary and sedative filling. The difficulty in this is its too free use as a temporary filling. Herein lies a practice to be condemned.

The use of silver nitrate in the office is limited. It reduces sensitiveness and may check decay or disintegration about the necks of the teeth. It must be confined to the posterior teeth, as it discolors tooth tissue. Silver nitrate is an escharotic. It burns, and should not be used on soft tissues under any conditions.

In conjunction with a reducing agent, such as oil of cloves or formalin, it has been, and may still be, used as a disin-

33. Footnote 7, p. 167.

34. Johnston, R. W.: Clean Handpieces, Practice in Paragraphs, J.A.D.A., 23:1394 (Aug.) 1935.

fectant in root-canal therapy or deep caries. It is now largely discarded.

For treatment of diseases of the soft tissues, such as stomatitis, a mouth wash of sodium chloride or sodium bicarbonate, or a mixture of the two, is probably the best. These areas should be kept clean and not be irritated by the application of strong drugs. Acriflavine may be satisfactory, though it is doubtful that a disinfectant is required. This drug promotes healing.

Two representative lists of drugs may be found in *Dental Rays,* alumni journal of the University of Pittsburgh Dental School, January, 1936, and the *Dental Outlook,* February, 1936.

DENTIFRICES

Just a word may be said concerning dentifrices. They have no therapeutic value: they are only aids in cleaning the teeth. Soap does not clean the hands or body, neither does it do the work in the laundry. Plenty of water and "elbow grease" do the job, and the soap assists materially. The same is true of the dentifrice. Only those dentifrices approved by the Council should be used in order to avoid abuse of the hard or soft tissues through the application of harmful drugs or other substances. Why should we, as members of a profession, allow ourselves to be the agents of conscienceless dentifrice vendors?

No two writers would list exactly the same drugs. The point is that we shall use such as have been proved to be satisfactory and have been accepted by the Council on Dental Therapeutics of the American Dental Association. By so doing, one can know that he is following approved therapeutics, and that he is giving to his patient the best that science knows. With the knowledge now available, it is quite possible to select the drug which, in a given case, will give the best result. Let us use the knowledge which pharmacology provides. We should do this for the benefit of our patients, and we must do it in self-protection, for our younger confrères are taught it. We must remember that above all other requirements, two fall heavily upon us: We must do our work with the least possible discomfort to the patient and we must treat infections scientifically.

ART—A FUNDAMENTAL IN DENTURE PROSTHESIS*

By M. M. HOUSE, D.D.S., Whittier, Calif.

THERE are but few words in our vocabulary that have a more diversified application than the word art. I have therefore chosen three phases of the word art, as defined by Webster, as applying well to the subject to be discussed.

1. Art is skill, dexterity or the power of performing certain actions as acquired by experience, study or observation.

2. Art is the application of skill and taste to production according to esthetic principles.

3. Art is an occupation having to do with the theory or practice of taste in the expression of beauty in form, color, speech, sound or movement.

The ideal in denture prosthesis is the

*Read before the Section on Full Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

DIAGNOSTIC CHART

DATE..... NAME..... ADDRESS..... CASE NO.....

AGE..... SEX {MALE / FEMALE} {MARRIED / SINGLE} {DIVORCED / WIDOW} {HEIGHT / WEIGHT} {RACE / OCCUPATION}

WHERE BORN..... WHERE LIVED..... PHYSICIAN.....

PRESENT ILLNESS:

CHIEF COMPLAINT {1. ..... DURATION..... / 2. ..... DURATION.....}

OTHER COMPLAINTS {1. ..... DURATION..... / 2. ..... DURATION..... / 3. ..... DURATION.....}

Remarks: .....

PAST HISTORY:

CHILDHOOD DISEASES {CHICKEN-POX..... DIPHTHERIA..... EARACHE..... INFANTILE PARALYSIS..... SCARLET FEVER..... TONSILITIS..... / WHOOPING COUGH..... MEASLES..... MUMPS..... OTHER DISEASES:.....}

ADULT DISEASES {APPENDICITIS..... ARTHRITIS..... ASTHMA..... BRONCHITIS..... BLADDER DISEASE..... CONVULSIONS..... CANCER..... / CHOLECYSTITIS..... CONSTIPATION..... DIABETES..... ECZEMA..... EASILY FATIGUED..... FREQUENT COLDS..... FAINTING SPELLS..... / MALARIA..... HEART TROUBLE..... INFLUENZA..... LOSING WEIGHT..... MENSTRUATION..... MENOPAUSE..... NEPHRITIS..... / NERVOUS BREAKDOWN..... NEURALGIA..... PNEUMONIA..... PLEURISY..... RHEUMATIC FEVER..... RUPTURE..... SPASMS..... / TUBERCULOSIS..... TYPHOID FEVER..... OTHER DISEASES: ..... ACCIDENTS:..... / OPERATIONS:.....}

Remarks: .....

FAMILY DISEASES: TUBERCULOSIS..... EPILEPSY..... HEMOPHALIA..... COLOR BLINDNESS.....

Remarks: .....

SYSTEMIC DISEASES:

EYE..... EAR..... NOSE..... THROAT..... ORAL CAVITY..... RESPIRATORY..... CARDIO-VASCULAR..... GASTRO-INTESTINAL..... GENITO-URINARY.....

Remarks: .....

HABITS: AIR..... REST..... EXERCISE..... COFFEE..... TEA..... STIMULANTS..... DRUGS.....

Remarks: .....

Nutritional Habits: .....

FAMILY HISTORY:

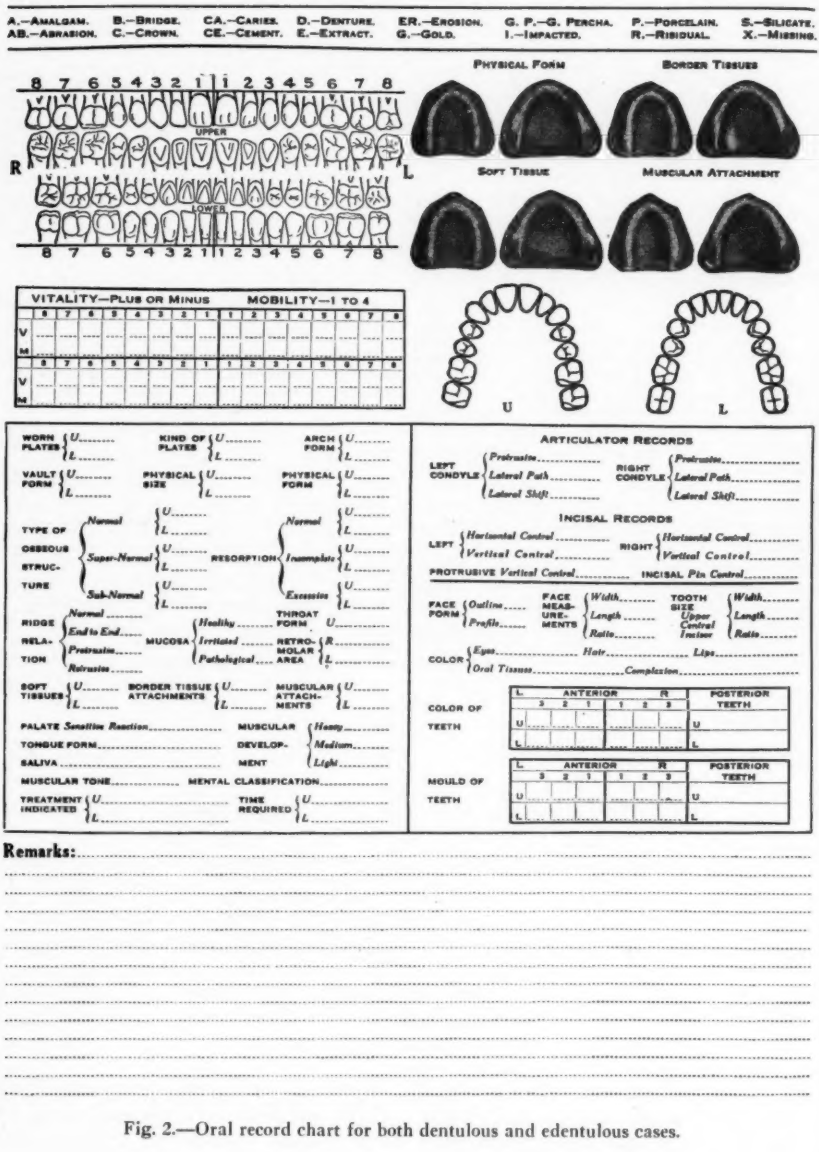
NUMBER OF CHILDREN..... HEALTH.....

FATHER	LIVING / DEAD	DISEASES / CAUSE	MOTHER	LIVING / DEAD	DISEASES / CAUSE
	FATHER'S SIDE			MOTHER'S SIDE	
GRAND FATHER	LIVING / DEAD	DISEASES / CAUSE	GRAND FATHER	LIVING / DEAD	DISEASES / CAUSE
GRAND MOTHER	LIVING / DEAD	DISEASES / CAUSE	GRAND MOTHER	LIVING / DEAD	DISEASES / CAUSE
BROTHERS	LIVING / DEAD	DISEASES / CAUSE	SISTERS	LIVING / DEAD	DISEASES / CAUSE

FORM 1002—1000— (OVER)

Fig. 1.—Physical record chart.

production of artificial substitutes that will restore mechanical function, facial form and, to a high degree, the esthetic values of facial expression. The objective of this ideal is impossible of attainment unless one has made a thorough study of the biologic, mechanical, technical and fine arts in this phase of prosthesis.



Remarks:.....

Fig. 2.—Oral record chart for both dentulous and edentulous cases.

As the variability of the biologic factors in each case presented for denture service predetermines the procedure, treatment and prognosis, the art of diagnosis is fundamental to the health of the patient and to the success of the dental practitioner.

Figure 1 shows a physical record chart. This is used for taking a record of the age, past and present illness, surgical operations and nutritional habits and the oral history and family history as it pertains to the hereditary background of the patient.

Figure 2 shows an oral record chart for both dentulous and edentulous cases.

Figure 3 shows roentgenograms of the edentulous jaws of a patient, aged 54; height, 5 feet 11 inches; weight, 185 pounds; a man apparently immune to illness during his lifetime, of good nutritional habits and by occupation living out of doors most of the time. The heavy, highly calcified structure of the jaws, with regeneration of smooth cortical bone over the ridge crests, is evident. The mucosa is uniform in thickness over the denture base areas of the jaws. The prognosis for denture service is ideal, but porcelain teeth cannot be made strong enough to withstand the stresses of masticating function.

Figure 4 shows the jaws of a skull having a type of bone structure and cortical bone over the ridge crests comparable to that shown in Figure 3.

Figure 5 shows roentgenograms of the jaws of a woman, aged 56, height, 5 feet 4 inches, who had had most of the childhood diseases and also rheumatic fever. She had had dental trouble from early childhood and continuously through life, including the present condition as revealed in the roentgenograms of the jaws. She was highly nervous and 20 pounds underweight. The blood pressure was 90. Tonsillectomy, appendectomy and hemorrhoidectomy (twice) had been performed. The patient was suffering from severe rectal trouble and chronic constipation. She took no exercise and was on a limited diet. There was a family history of tuberculosis. The patient had had fifteen upper and lower sets of teeth. She experienced continuous tissue change with loosening of the dentures, resulting in complete elimination of certain foods from her diet owing to an inability to masticate them. There had consequently been a further decline in health following the extraction of most of the natural teeth, as revealed by the roentgenogram. Because of a change in personal appearance, she had become very much depressed mentally.

The jaw structure in this case was very light, with edentulous ridges that were thin and void of cortical bone. The mucosa was very thin over the ridge crests. There

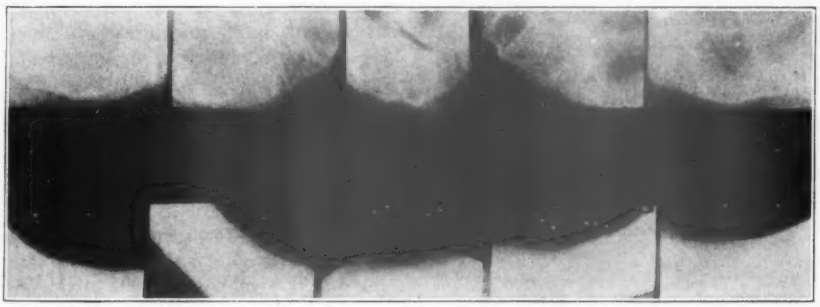


Fig. 3.—Edentulous jaws of patient, aged 54, having ideal bone structure.

was no possibility of comparative comfort and efficiency in this case as in Case 1.

The treatment indicated is self-evident and the prognosis is wholly dependent on the physical and mental improvement previous to and following the placing of dentures. The mechanical efficiency of dentures would be greatly limited under the best conditions possible to attain in this case.

Roentgenographic studies of edentulous jaws as reported by various investigators reveal the fact that from 35 to 40 per cent have root fragments, residual areas, impacted teeth or foreign bodies

Fig. 4.—Jaws of skull having type of bone structure and cortical bone over ridge crests comparable to that shown in Figure 3.

present. It is evident that the degree of success possible in denture service is dependent on the biologic factors in each case, some of which can be improved by a correct diagnosis and proper treatment previous to the construction of dentures.

The importance of thoroughness in examination and diagnosis of cases, dentulous and edentulous, cannot be overestimated.

The mechanical art of denture prosthesis is fundamental to the fine art (esthetic value) and also the mechanical and physiologic function of dentures. The esthetic value of denture prosthesis begins with the mechanical art of making the impression.

The denture bases are frames or forms over which the facial tissues and muscles are draped and by which they are supported. The correct form of the border of the maxillary impression is requisite for supporting the buccinator and the levator muscles, which, in turn, give proper support and tension to the orbicularis oris muscle. This is essential to establish a good esthetic value in the facial expression.

Figure 6 shows vulcanite trays properly formed for muscle-trimming the upper impression and molding the border forms by functional movements of the facial muscles and tissues.

Another principle in the properly formed maxillary tray is mechanical control, for placement of the areolar tissues in the cuspid and incisor areas in making the impression. The vulcanite lower tray is of equal value for mechanically controlling areolar tissues and utilizing the base area in muscle trimming the lower impression by functional movements of the muscles and tissues. The principles involved in making correct impressions, both maxillary and mandibular, are:

1. To utilize the maximum base area by employing an impression tray of correct size and form.

2. To establish the correct length, thickness and form of the peripheral borders by functional movements of the muscles, tissues, tongue and mandible in its opening, lateral and protrusive movements. The mandibular movements are effective in molding the peripheral borders of both the maxillary and the mandibular impressions.

3. To control and place the areolar tissues in molding and sealing the peripheral borders with the impression material.

4. To acquire accurate adaptation to the tissues throughout the base areas.

Each step in the technical sequence of denture prosthesis must be fundamentally correct in its application to the biologic and mechanical principles involved, if uniform results are to be obtained. The choice of impression materials and technical procedures may be varied as deemed best in consideration of the conditions present in each case, but the degree of success possible of attainment is dependent on the skill, experience, knowledge, dexterity and thoroughness of the operator.

The making of casts to reproduce accurately in the finished dentures the border forms and tissue detail of the impressions is a mechanical art requiring experience, skill, dexterity, thoroughness and detail in handling the materials used.

Figure 7 shows casts correctly made to reproduce in the finished restorations the border forms and tissue detail of the impressions.

Almost universal inaccuracy in the art of making dentures is evident in the biteplates used for registering maxillary relations. A registration baseplate should be rigid enough to resist the functional forces applied and have the same accuracy of adaptation to the base area to be utilized as the finished denture base. By the use of vulcanite impression trays as registration bases, perfect adaptation to the casts and tissues can be maintained. The undercut areas must be relieved so that the baseplate can be removed from the cast, either by shortening the border length, or packing the undercut areas on the cast with modeling clay and tinfoiling the cast preparatory to putting a wash in the tray for taking a new adaptation to the cast.

Wax occlusal rims homogeneous in texture and properly formed are ideal for establishing correct facial contour in registering the intermaxillary dimension.

Figure 8 shows registration bases with homogeneous wax occlusal rims as described.

Next, in the technical sequence, is registration of the centric and eccentric relationships of the mandible to the maxilla, the correctness of which is fundamental to the mechanical success of a noninterfering functional occlusion of the teeth.

An analysis of the fundamental principles involved in this phase of the work may be helpful in clarifying one of the most complex problems, both in principle and technical application.

TYPES OF MANDIBULAR REGISTRATION

Positional	Intra-oral	Checkbites
	Combination Intra-extra-oral	Stansbery
	Extra-oral	Gysi Phillips
Functional	Intra-oral	Luce-Needles

The fundamental principles involved are:

1. Accurate registration of the functional centric and eccentric relations of the mandible to the maxilla by diagrams or forms of the mandibular movements.

2. Registration of the effect of resilience of the tissues under the forces of musculation used in masticating function.

3. Redevelopment of the mandibular functions in cases that have developed abnormal or habitual function, due to occlusal interference of the teeth, either natural or artificial.

4. Registrations (by the patient), accurate and definite in form for setting a fully adjustable articulator.

Our concept of an ideal occlusion is a noninterfering functional occlusion of the teeth. This includes balanced occlusion, synchronizing the intercuspations of the teeth with mandibular function and equilibrium of the restored areas in the centric and eccentric ranges of incising and masticating function.

registrations: intra-oral, extra-oral and a combination of intra-oral and extra-oral methods, as shown in the accompanying table.

Tests made in the practical application of these methods of mandibular registration have led me to the following conclusions:

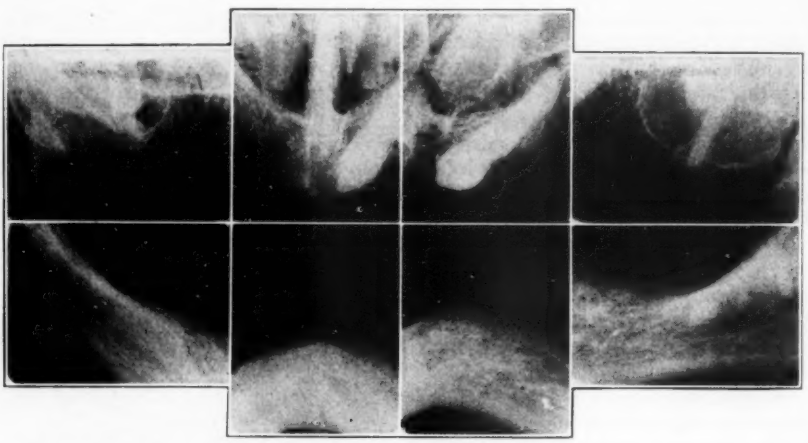


Fig. 5.—Jaws of a woman, aged 56, having very low grade or deficient mineralization of bone structure.

Fig. 6.—Vulcanite trays properly formed for muscle-trimming upper impression and molding border forms by functional movement of facial muscles and tissues.

A classification of registration methods in use at present may be helpful in determining the degree of their practical application to the fundamental principles involved in mandibular registrations.

There are three types of mandibular

1. Dr. Gysi gave to the profession a fundamentally correct principle for determining the correct centric and eccentric relationships of the mandible to the maxilla by the use of the gothic arch record. The extra-oral graphic record that

Gysi recommended does not meet fully the fundamental principles involved in mandibular registrations.

2. Checkbites are of questionable value unless taken in conjunction with the gothic arch record.

3. Tests made with the center stud registration method proved inaccurate as a basis of equalizing the pressure of the bases on the tissues bilaterally. The plaster checkbites used by Stansbery meet the requirement of definite records for setting the instrument, which the graphic records make difficult.

4. The Luce[1] and Needles[2] methods are listed as functional in the classification because the curved bite-rims make

Fig. 7.—Casts correctly made to reproduce in finished restorations border forms and tissue detail of impressions.

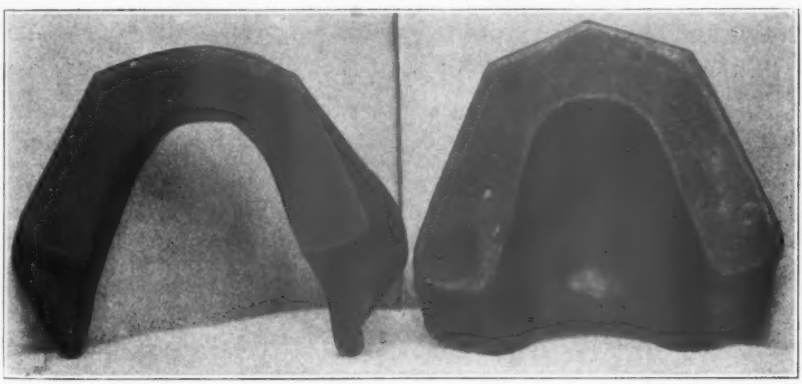


Fig. 8.—Registration bases with homogeneous wax occlusal rims.

1. Luce, C. E.: Mandibular Movements and Articulator Question, Ash's Quarterly, 1911, pp. 921-931.

2. Needles, J. W.: Mandibular Movements and Articulator Design, J.A.D.A., 9:927-935 (Oct.) 1922.

possible bilateral contact in all mandibular function without limitation of the force applied. An analysis of their technical application is of much interest.

studs as applied by Needles have made possible an improvement in the accuracy and practical application of functional registration.

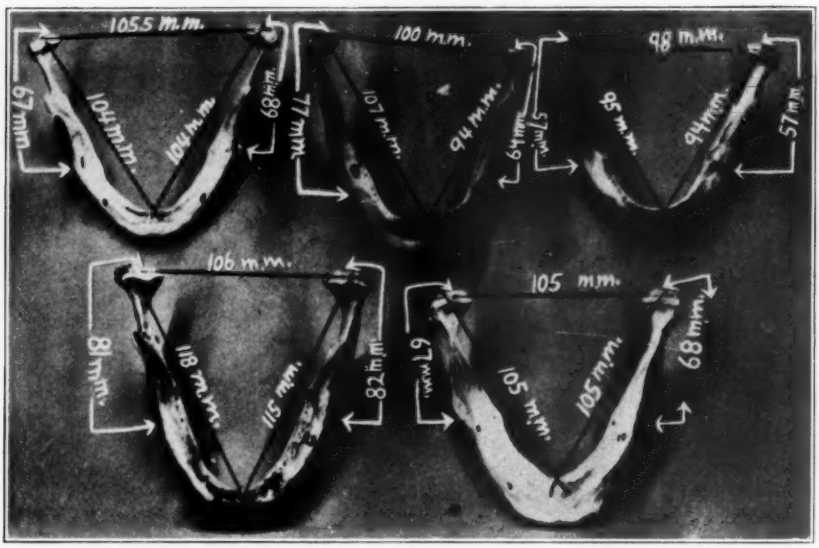


Fig. 9.—Five edentulous mandibles. The unilateral variation in the form of each specimen is indicated.

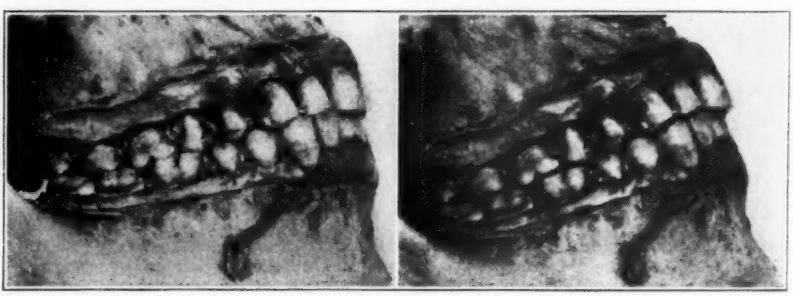


Fig. 10.—Left, wet specimen conforming to square type. The menisci and capsular ligaments are intact. Right, teeth separated when Bennett movement is not incorporated with functions of teeth.

Comparative tests made with four registration studs as applied by Luce and three

Luce used four studs in the bicuspid and molar areas and had the patient reg-

ister only the lateral movements. He used four round headed tacks in soft wax placed on the surface of a harder wax bite-rim. This registers only a part of the anatomic angulations of the mandibular functions as well as the effects of resilience of the tissues.

Needles used three studs, one in the central incisor area and one in the right and one in the left molar area. The surface of the bite-rims were curved and the patient registered both the lateral and protrusive functions of the mandible.

The curve formed on the bite-rim must necessarily be arbitrarily established; hence, the discussion as to the accuracy and inaccuracy of this method of regis-

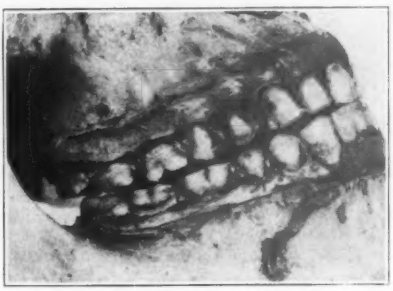


Fig. 11.—Jaws in which posterior teeth do not occlude when anterior teeth are in incisive position.

tration. We are all familiar with the fact that bilateral symmetry of the anatomic form of the mandible and temporomandibular articulation is seldom if ever found. Form and function being synonymous, we find unilateral variations in the degrees of angulation of mandibular movements. There is also a variation in the protrusive and lateral angulations of the same side in the majority of cases.

Figure 9 shows five edentulous mandibles and the unilateral variation in the form of each specimen.

We should be able to visualize the anatomic variations in form when we record the mandibular registrations of each case. In the majority of cases, we not only have the biologic variability of form and function, but also have the degenerative changes due to the progressive loss of the natural teeth, which, in turn, increases the variability of form and function of the parts involved.

Figure 10, left, shows a wet specimen dominant as to the square type. This specimen has the meniscus opened on one side and the meniscus and capsular ligament intact on the opposite side. There is a full complement of perfect teeth, which have balanced occlusion in lateral function, in conjunction with a Bennett or direct lateral movement of the condyles in the glenoid fossae.

Figure 10, right, shows the teeth separated when the Bennett movement is not incorporated with the functions of the teeth. The posterior teeth do not occlude when the anterior teeth are in incisive function as shown in Figure 11.

Figure 12 shows a skull from which the maxillary posterior teeth on the left side have been removed for a long time. It is evident that the right side was in mastication. The glenoid fossae on the left side is very deep, with an almost vertical angulation downward to the eminentia articularis. The glenoid fossa on the right side, where function has been more normal, is shallow. The musculation, or power, on the left side has been between the work (the teeth) and the fulcrum (the condyle head and the glenoid fossae), which has been a contributing factor to the extreme variation in the forms of the temporomandibular articulation.

These specimens show definitely that the resultant of these unilateral variations in form and function would be a composite curve in the occlusions of the teeth if a noninterfering functional occlusion

were made in artificial restorations for a patient having such biologic variability in the form and functions of the associated structures in masticating function.

Figure 13 shows the protrusive anatomic angulation and the variations of such a case.

The accuracy of registering such mandibular movements has been made possible by utilizing a combination of the Luce and Needles methods previously mentioned.

Measurement of the curves of occlusion made by various investigators shows the radii vary from $2\frac{1}{2}$ to 10 inches. Therefore, a curve having a radius of 4 inches serves as a medium between the extremes, requiring the least amount of correction to fit the functions of any extreme case.

Fig. 12.—Skull from which maxillary posterior teeth on left side have been removed for a long time previous to death. The variation in form and depth of the glenoid fossae is evident. The form of the right fossa, which was the functioning side, with the posterior teeth present is normal. The left fossa is very deep, with the anterior wall vertical down to the eminentia articularis. The head of the condyle became a fulcrum with pivotal action during musculation.

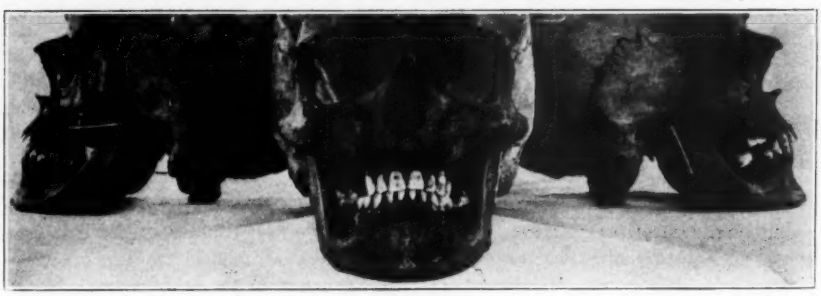


Fig. 13.—Protrusive anatomic angulation and variations of case.

Figure 14 shows the use of a curve having a 4-inch radius. This makes it unnecessary to have the patient chew in a curve concentric with mandibular functions previous to placing the registration studs. The surface contact of the occlusal rims has been reduced to a minimum by the use of four registration studs placed in the bicuspid and molar areas, as used by Luce.

The use of four studs in the bicuspid and molar areas of the occlusal rims has proved to be fundamentally correct in equalizing the pressures of musculation

Fig. 14.—Use of curve having 4-inch radius.

on the denture bases in masticating function. (Fig. 15.)

The intermaxillary relation established at closure for the facial dimension is retained by a limited contact area of the occlusal wax rim between the registration studs. In this way, a composite curve, if present, is accommodated without interference of the occlusal rims and equilibrium of the restored areas is established. The tracing studs form diagrams in the modeling compound which register definitely the centric, retrusive, protrusive, lateral and vertical relations of the mandible to the maxilla.

Redevelopment of function, when lost, is accomplished by the resistance of the

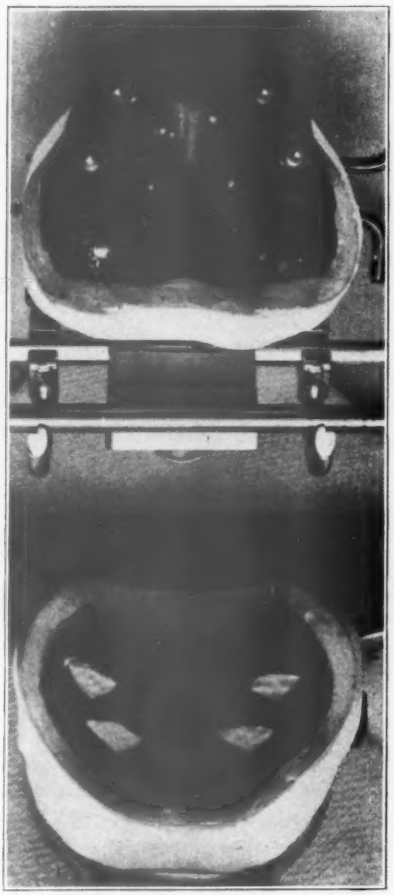


Fig. 15.—Use of four studs in bicuspid and molar areas on occlusal rims.

modeling compound to the cutting of definite diagrams with the tracing studs. The muscles become fatigued from chew-

ing, which causes the mandible to return to its functional centric and eccentric positions. These diagrams, when correctly made, differentiate in the gothic arch records the functional centric relationship of the mandible to the maxilla from the retrusive position of the mandible. The diagrams in the modeling compound are also definite for adjusting a fully adjustable articulator to reproduce the functional centric and eccentric relations of the mandible to the maxilla. The correct intermaxillary dimension and functional centric relationship of the mandible to the maxilla are fundamental to the esthetic, mechanical and physiologic function of each case. The mechanical and technical phases of denture prosthesis can be made uniformly accurate, but the biologic factors involved will determine the degree of comfort and masticating efficiency possible in each individual case.

The fine art of denture prosthesis, when analyzed, is dependent on the skill and experience of the artisan, and his knowledge of the theory and application of taste in the expression of beauty of form, color, speech, sound and move-

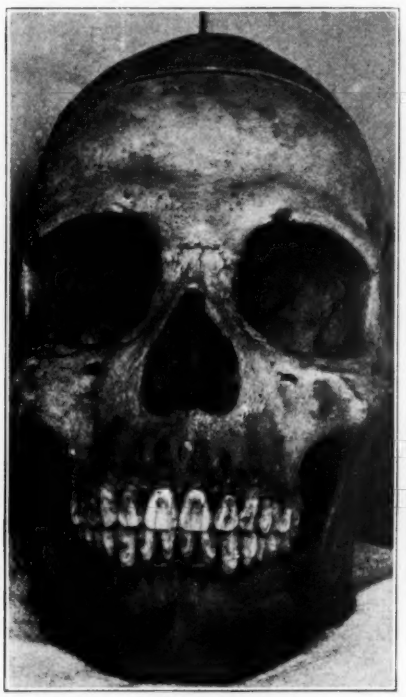


Fig. 16.—Skull having typical combination typal square tapering forms of teeth. The form of the alveolar structure in the labial and buccal surfaces is to be noted.

Fig. 17.—Skull having pure typal tapering teeth. The form of the alveolar structure in the labial and buccal surfaces is to be noted.

ment. The primary factors in the esthetic principles of nature's design in the beauty and character of facial expression is face form, tooth form, arch form and alinement of teeth in the arch.

For the benefit of convenience in study and simplification in teaching this harmony of face and tooth forms, J. Leon Williams[3] applied the classification of face forms to tooth forms, which is fundamental in its application to the fine art of denture prosthesis. There are three basic or pure typal forms: square, tapering and ovoid forms of faces and teeth. Pure typal forms are seldom found, but we must have a definite knowledge of them before we can understand and classify the combinations of them in the faces and teeth. In the combinations of the pure typal forms of faces and teeth, we see one side of the face dominant as to one typal form and the other side dominant as to another type. The teeth also vary in their typal forms in many of these cases, though we see harmony and beauty in the facial expression. This harmony and beauty are due to the unilateral variability in face form and the tooth forms plus their axial and rotational alinement in the arch.

Fig. 18.—Skull conforming to pure typal ovoid teeth. The form of the alveolar structures in the labial and buccal surfaces is to be noted.

Another factor in all pure typal and combination typal forms of faces and teeth is the convexity or curvature of the labial and buccal forms of the teeth. This curvature of the tooth forms, both anterior and posterior, and their axial alinement form a harmony or continuity of line with the profile and outline forms of the face.

The arch form and the gingivoclusal curvature of the maxillary bicuspid and molar teeth in fine developments form a continuity of line from the cuspids distally that is in harmony with the facial outline form.

Figure 16 shows a skull having typical combination typal square tapering forms of teeth. This specimen has the heavy osseous structure and form of the square type. The maxillary form of the alveolar structure from cuspid to cuspid and also the form of the symphysis and alveolar structure of the mandible and tooth forms and their alinement are to be noted.

Figure 17 shows a pure typal tapering specimen. The light osseous structure and forms of the teeth and their alinement are to be noted. (Fig. 16.)

Figure 18 shows a skull conforming to

3. Williams, J. L.: New Classification of Natural and Artificial Teeth, New York City: Dentists Supply Co.

the ovoid type in osseous structure and form. (Figs. 16-17.) These specimens present the principles of tooth form and alinement which are fundamental to the application of taste in the expression of beauty in the form of artificial restoration of facial contour and esthetic value to the facial expression.

The fundamental principles involved in the fine art of denture prosthesis are far more complex than the mechanical and technical phases of the work. They are so interwoven in their application that they all become a part of the whole in the finished work.

The ideal method of reproducing the character of facial expression in denture prosthesis, for cases showing fine development, is to follow as nearly as possible the form of the alveolar structures, soft tissues, arch form, tooth form, color and arrangement of the natural teeth in the arch, as they were previous to degenerative changes. This procedure is not difficult in cases having esthetic value as to tooth form and alinement, when records and casts are made previous to the extraction of the teeth. This ideal procedure is possible in only a limited number of cases requiring denture service, but many who desire such service and could have it are not given the opportunity.

Figure 19 reveals another principle of nature in tooth alinement that applies to all pure typal and combination typal forms of cases, in the orientation of the plane of occlusion. This plane of occlusion is parallel bilaterally with the orbital plane. The maxillary central incisors, cuspids and buccal cusps of the bicuspids, and also the buccal and mesiolingual cusps of the first molars, make contact with this plane.

Fig. 19.—Plane of occlusion parallel to orbital plane.

Figure 20 illustrates the anteroposterior and lateral curves for balancing the occlusion of the teeth in the eccentric ranges of function, which begins at the oblique ridge of the maxillary first molar. The maxillary first molars have a distal axial alinement. The maxillary second

molars have a mesial and palatal axial alinement, and the maxillary third molars have a greater degree of mesial and palatal axial alinement than the second molars. The cusp forms and the axial alinement of the maxillary second and third molars in conjunction with the short distolingual cusp of the first molars form the anteroposterior and lateral curves of the maxillary teeth.

Figure 21 shows the anatomic factors to be described in the following paragraphs.

The anatomic forms of the cusps of the mandibular bicuspid and molar teeth and their axial alinement harmonize with the cusp forms and axial alinement of the maxillary bicuspid and molar teeth to form the mechanical curves for balancing occlusion.

Fig. 20.—Central incisors, cuspid, buccal cusps of bicuspids and buccal cusps of first molar as they contact plane; curve of occlusion of second and third molars as they are positioned to plane.

The mesial marginal ridges of the maxillary second molars are higher vertically than the distal marginal ridges of the maxillary first molars. This allows the mandibular second molar to function with the maxillary first molars in all ranges of balanced occlusion.

A thorough knowledge of these principles simplifies the art of orienting the plane of occlusion in prosthesis. In practical application, they are fundamental to the highest degree of esthetic value and the mechanical function of dentures.

An analysis of natural tooth forms reveals that color harmony is dependent on or secondary to tooth form. This is due to the variations in the surface forms of teeth from which the reflection and refraction of light is varied in harmony with each surface form. Color value in artificial teeth is dependent on the surface form, distribution of color, degree of glazing of the porcelain and absorption and reflection of light. The talent of the artisan and the selection of the denture base material are also to be considered in the fine art of denture prosthesis as they affect the harmony in color of the teeth.

Fig. 21.—Anatomic factors as they pertain to mechanical curves for balancing occlusion.

The art of phonetics includes speech, sound and movement. The first principle involved in the development of the correct form of dentures for the greatest value in speech, sound and movement of the tongue and lips in phonating is to establish the correct relationship of the mandible to the maxilla. This is also a requirement for setting the teeth to the correct typal arch forms for esthetic value in facial expression, for ideal ridge rela-

tions to resist the stress of masticating function and to make ideal form and support for the functions of the tongue and lips in phonating.

CONCLUSIONS

No branch or specialty of the dental art requires greater skill, more experience and more diversified knowledge than denture prosthesis.

The biologic factors in each case predetermine the degree of efficiency possible of attainment in denture service.

Thoroughness in examination and diagnosis is fundamental to the health of patients requiring denture service, whether dentulous or edentulous.

A correct prognosis and education of the patient are to the best interest of both the dentist and patient.

The fundamental principles involved in both the fine art and the mechanical art of denture prosthesis should be more thoroughly studied and clarified for educational advancement in this phase of dental art.

The contribution of J. Leo Williams in the classification and forms of artificial teeth and their selection is the only improvement made in tooth forms in the thirty-six years of my experience in dentistry.

The fine art of denture prosthesis will not improve until better tooth forms and improved methods for their selection in harmony with face forms, based upon the fundamental work of Berry[4] and Williams, are made available to the profession.

Denture work as practiced generally at present is so divided in mechanical construction and application between the dentist and the commercial laboratories that cooperative education of the dentist and the technician is essential, if improvement in denture service is to be made possible.

It seems logical that a well-organized technical sequence accurately applied to the biologic and esthetic principles involved in each case presented for denture service would be the ideal in human effort.

4. Berry, F. H.: Institutes of Pedagogics, December, 1903; Dentist's Mag., April, 1906, p. 405.

IS TEEN-AGE CARIES AN ENDOCRINE PROBLEM?*

By FLOYDE EDDY HOGEBOOM, D.D.S., F.A.C.D., Los Angeles, Calif.

ALL through the ages, certain peculiarities of physical development have made men dwarfs or giants, fat or thin, brilliant or dull, normal or abnormal. Around these abnormal conditions, stories and myths have grown up of dwarfs, goblins, giants and witches. Only in recent years have medical men been able to determine some of the causes of these conditions. Because of their mystery, a volume of misinformation and legend has surrounded the etiology and treatment of endocrine dystrophies. The story of David and Goliath is a historical record of interest. Samuel II, chapter 21, verse 20 says, "And there was again war at Gath, where a man of great stature, that had on every hand six fingers, and

*Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Eighth Session of the American Dental Association, San Francisco, Calif., July 16, 1936.

on every foot six toes, four and twenty in number; and he was born to the giant."

Senator Beverage, in his life of Lincoln, attributes the deep periods of melancholy which overtook Lincoln from time to time to an endocrine imbalance. He says, "Herndon and many others thought that political disappointment and Mrs. Lincoln's temper combined were the causes which produced Lincoln's sadness; although his partner also included derangement of secretions."[1]

There is such a mixture of nationalities in this country that it will be centuries before a homogeneous American group will emerge. Therefore, the racial background and constitutional individuality must ever be kept in mind in making a diagnosis. The constitution and the personality are based largely on this racial background and the series of glands known as the endocrine glands.

The definition of constitution, as given by Pende,[2] is interesting:

> The constitution is the morphological, physiological and psychological resultant (variable in each individual) of the properties of all the cellular and humoral elements of the body, and of the combination of these in a special cellular state having a balance and functional output of its own, a given capacity for adaptation and a mode of reaction to its environmental stimuli. Such a resultant is determined primarily by the laws of heredity and secondarily by the disturbing influence exercised by the environment upon the individual's hereditary plan of organization.

After knowing the constitutional background, we must further study the environmental influence, both intrinsic and extrinsic, that brings about normal growth and development and variations of these influences that inhibit or accelerate life processes. The dentist sees only the symptoms and results in the oral area and must have further knowledge, as well as cooperation with the physician, to prevent these oral malformations and diseases. In an attempt to relate certain endocrine disorders to the dentist's field of action, I should like to present the following outline of endocrine disorders with resulting dental symptoms.[3]

I. Thyroid:

A. Congenital hypothyroidism (cretinism).

1. Slow embryonic differentiation and prenatal development including osseous centers and tooth bud formations; late eruption of deciduous teeth, sometimes as late as from twelfth to fourteenth month; retarded exfoliation of deciduous teeth, resulting in eruption, crowding and various degrees of malocclusion of permanent teeth.

B. Acquired hypothyroidism.

1. Infantile myxedema.
2. Adult myxedema.
3. Masked hypothyroidism.

If this acquired hypothyroidism occurs during infancy, the same conditions obtain as in congenital hypothyroidism. Caries is prevalent.

C. Goiter.

1. Nontoxic.
2. Toxic.

This is unusual in childhood. Rampant caries is present.

II. Pituitary (hypophysis):

A. Hypopituitarism (anterior lobe deficiency).

1. Small teeth and small dental and facial structures, in keeping with other infantile characteristics (Lorain-Levi type).

2. Deficiency of growth hormone resulting in nondevelopment of bones of the face, particularly maxillae, indicated by narrow, constricted, high arch, and more or

1. Beverage, A. J.: Abraham Lincoln, Vol. I., Boston: Houghton Mifflin Publishing Co., p. 525.

2. Pende, Nicola: Constitutional Inadequacies, Philadelphia: Lea & Febiger, 1928.

3. Hogeboom, F. E.: Practical Pedodontia, Ed. 3, St. Louis: C. V. Mosby Co.

less receding chin; normal sized teeth crowded because of failure of bones to widen, malocclusion resulting.

B. Hyperpituitarism (anterior lobe hyperactivity).

1. Early gigantism.

(*a*) Premature appearance of teeth.

(*b*) Separation of the teeth even in early life, especially between incisors and cuspids.

(*c*) Teeth unusually large in accordance with overgrowth.

(*d*) Normal arch form, or approaching normal, with little malocclusion.

2. Acromegaly.

(*a*) Wide separation of the teeth in outward and forward direction.

(*b*) Extreme overdevelopment of mandible.

(*c*) Hexagonal shape to face.

(*d*) Presence of husky, deep voice.

(*e*) Presence of thick lips and bulbous nose.

(*f*) Caries and gingival difficulties complicated by separation of teeth.

(*g*) Tufting of phalanges shown in roentgenogram of hand.

C. Adiposogenitalism (Fröhlich's syndrome).

1. Good arch form with practically no malocclusion.

2. Very little caries.

3. Pits and fissures free from openings and well calcified.

III. Gonadal disorders:

1. Factor in calcium metabolism and timing of epiphyseal closure.

2. Disturbed calcium metabolism affecting dentition in early adolescence.

3. Rampant caries.

4. In cases of hypergenitalism, large teeth the rule, probably because of hyperactivity of anterior lobe of pituitary gland.

IV. Parathyroids:

A. Hypoparathyroidism (hypocalcemia).

1. Reduction of blood calcium resulting in spasmophilia and tetany.

(*a*) Chvostek's sign (facial nerve spasm).

(*b*) Trousseau's sign (obstetrical hand spasm).

2. Enamel defects in form of pits (not to be confused with pits resulting from exanthematous fevers during the formative period).

3. Marked nervous irritability.

B. Hyperparathyroidism (hypercalcemia).

1. Rise in diffusible and especially ionized diffusible calcium content of blood.

C. Demineralization of bony framework (osteitis fibrosa cystica, osteomalacia, osteoporosis, Paget's disease).

1. Areas of residual infection in jaw bones which may actually be secondary to systemic demineralization.

2. Small cystic areas of resorption in the mandible and maxillae not uncommon.

This outline shows how little we know about the effects on dental structures, and yet it will emphasize the part they play in growth and development.

One of the most puzzling and difficult conditions that the dentist has to face is "teen-age" interproximal caries. Dentists have devoted years to systematic care in an attempt to keep the mouths of growing children in a state of health, only to see beginning of interproximal caries in the teeth of these children when they reach 15, 16 or 17 years of age. Frequently we check over a mouth carefully with a mouth mirror and go over the pits and fissures with an explorer and see no caries. If we go further, as we should, and make full-mouth studies with bitewing films, we often see the small dark spots in the film which mean the decalcifying of the enamel below the contact point on the mesial and distal aspect of bicuspids and molars and frequently central and lateral incisors. We thought at one time that we could see all cavities with the aid of the mouth mirror and explorer, but any experienced man knows that it can't be done, and it has become increasingly important, therefore, to employ the bitewing film for thorough dental examination.

I believe that there are several factors

in interproximal dental caries in teen age. First, the child is reaching maturity, and there are tremendous growth strains and endocrine adjustments taking place at this time. We know the sex glands control the timing of the epiphyseal closure of the long bones. In some imperfectly understood way, calcium metabolism is influenced by the sex glands. This is demonstrated in castrated individuals when the epiphyses do not close at the normal time and the arms and legs grow to unusual length. It is also demonstrated at pregnancy, when rampant tooth decay is often present.

Secondly, the child is beginning to assert his freedom of choice in his everyday acts and associations. The early dietary habits instituted by a watchful mother are no longer carefully followed. The meals are not regular and the parties of friends induce the youth of high school and college age to eat concoctions of candy and similar things which are usually at hand on public school grounds.

Thirdly, young girls in particular are not drinking enough milk and other calcium, phosphorus and mineral containing foods to keep up the demands for normal growth and metabolism.

Taken together, I believe these conditions are the predisposing and exciting factors in the etiology of dental caries at this age. When we, as dentists, try to prevent this condition, we are groping in the dark. There is no systematized way of preventing these conditions as yet, but I believe we know enough to go a long way toward our goal.

A girl was brought to me at the age of 7 with two small cavities in her deciduous teeth. These were filled, and I have observed this child from time to time, and there was no further caries until the age of 15, when she came in with several beginning interproximal spots of caries. Why this sudden change?

Another case of this type was that of a girl of 16 whom I had not seen for several years. When she was 6 years of age, I had filled several deciduous teeth. From that time on, there has been no cavities in any of her teeth, but, at this last visit, two occlusal pits were found to be quite carious. Pits and fissure cavities are more liable to appear before adolescence and, in this case, there was no local reason that these areas should not have decayed in earlier years since the pits and fissures were of the deep type. But the teeth remained intact until about the sixteenth year, when the breakdown began. When I discussed the matter with her mother, I found that the patient's menstrual periods had practically stopped about a year and a half before and that the physician who was treating her was giving heavy doses of thyroid. I felt quite sure that this endocrine dysfunction was the exciting factor in the appearance of caries in her mouth. I am told by the endocrinologist who subsequently took over the case that it is just as bad to overdose with thyroid in a case of this type as it is to permit the hypothyroidism to continue in that it probably brings about a condition where calcium is withdrawn from utilization.

These two cases are typical of thousands that dentists are seeing year in and year out. Prime[4] says:

A statistician has worked out the startling fact that, in this country, 2,250,000 boys and girls reach the age of 16 every year. This reveals to us something of the magnitude of the demand for this type of service. That is near the age where the curve of caries reaches its height. Our records indicate these youngsters need from ten to thirty fillings each. It would require 1,125,000 working hours of the most painstaking meticulous work to examine them. It would require more than 35,000,000 working hours to do their

4. Prime, J. M.: Is Operative Dentistry Failing? J.A.D.A., 23:47 (Jan.) 1936.

work, if I may judge from my own records.

A significant fact is observed in diabetic children under insulin treatment. These children are either free from dental caries or have "arrested caries." Dentists who handle these children know that only prophylactic care is needed as a usual routine procedure. Broderick[5] recites cases wherein injection of insulin has brought about arrest of caries in a space of a few weeks. Boyd and Drain[6] first observed this fact in children under diabetic treatment. They attribute it to dietary correction rather than to the use of insulin, but the underlying endocrine dystrophy must not be lost sight of.

Endocrinology, after all, is just a part of physiology, and if we are ever to solve the problem of dental caries, the nutritionist must consider the effects of the internal secretions in a study of this problem and correlate his findings with those of the clinician.

The road to recovery and restoration of dental health is long and difficult. If there is a definite endocrinopathy, I do not believe the dentist should attempt to prescribe treatment in any case. He should be able to recognize the general signs and symptoms. I wish to emphasize that treatment rests with the physician and that the dentist and physician should cooperate in restoring the patient to health. We as dentists have a difficult task in restoring the damaged dental structures and, in this case, checking beginning interproximal caries. Probably the most practical way to restore these teeth with interproximal cavities is by the modified slice preparation gold inlays. It seems unfortunate to have to cut large cavities to reach these spots, but thus far there seems to be no other way. If we could prevent these cavities from starting by knowing what physiologic strains and stresses boys and girls must stand, what a tremendous step forward in preventive medicine and dentistry would be achieved! From the clinical observation of many children, I believe there is an endocrine factor in many of these cases, but, as yet, no one, to my knowledge, has made a thorough and scientific study of the problem from the dental point of view. I trust that, as time goes on, sound scientific data will become available from which we as dentists can be sure whether teen-age caries is an indication of endocrine disturbance.

5. Broderick, F. W.: Principles of Dental Medicine, Ed. 2, St. Louis: C. V. Mosby Company, 1936.

6. Boyd, J. D.; Drain, C. L., and Nelson, Martha: Dietary Control of Dental Caries, Am. J. Dis. Child., 38:721 (Oct.) 1929.

DISCUSSION

Hans Lisser, San Francisco, Calif.: Discussion of a subject of this nature demonstrates an increasing interest on the part of the dental profession in fundamental physiology and those underlying factors which may have considerable significance in the eruption, position and condition of the teeth. I am pleased with Dr. Hogeboom's sensible point of view in his appreciation of the fact that though the endocrines play a part in oral conditions, one must also take into consideration matters of constitution, heredity, environment, diet and nutrition. Furthermore, I am in entire accord with his caution in regard to therapy. I think it quite timely for him to stress the point that the administration of calcium, thyroid, ovarian substance, or whatnot, which the dentist might think indicated, is not a matter for the dentist to handle. Many of us in medicine feel none too secure in handling these products. I believe the greatest good will be derived from the standpoint of the patient, the dentist and physician, by mutual cooperation, as far as is possible. Such an outline as Dr. Hogeboom has prepared is very helpful and it would be profitable, from time to time, if an endocrinologist could show you a great number of slides of especially outspoken

cases of endocrine disease so that you could retain mental pictures of these abnormalities, and even though you are not in a position to study the whole body as we physicians are, still there is enough written on the face and even in the clothed body to give hints of disturbance of the ductless glands. If appearances make you suspicious of endocrine abnormality, the wise procedure is to mention this possibility to the mother or father; not to say that it *is* but that it *might* be an incretory fault, and suggest that it would be good judgment to consult the proper physician for further study. Now, as to the particular problem of "teen-age caries": Frankly, Dr. Hogeboom in bringing the subject before you has of necessity departed a little from the exact title of his paper. As I have remarked on previous occasions, alteration in function of several of the ductless glands results in disturbance of tooth eruption, arrangement and condition. Reference need be made only to the markedly delayed eruption of the teeth in children suffering from inadequate thyroid function, or, oppositely, unduly early appearance of the teeth in states of sexual precocity caused by tumors of the pineal or suprarenal gland, testicle or ovary. Furthermore, spacing of the teeth inevitably follows the widening of the jaw in the pituitary disease acromegaly, and malocclusion uniformly results from the associated prognathism. Conversely, overcrowding and overlapping, together with irregular positioning of the teeth, are found in the narrow jaw with high arched palate seen in pituitary infantilism. Rapid softening and decay of the teeth frequently occurs in adult thyroid deficiency and in diabetes mellitus, a disease which results from failure of the incretory portion of the pancreas. Then, too, it has been known for years that the parathyroid deficiency of childhood known as infantile tetany produces transverse furrows with parallel dark stripes and punctate enamel defects in the teeth. Furthermore, it is now definitely apparent that certain endocrinopathies adversely affect calcium metabolism. In fact, the parathyroid glands exert a specific effect. Studies of calcium absorption are difficult and, in spite of the increasing recognition of the importance of calcium and phosphorus in the economy of animals and plants, our knowledge of many aspects of the metabolism in these elements is scarcely more than primitive.[7] The parathyroid hormone mobilizes calcium and sees to it that a normal amount of this important mineral is constantly circulating in the blood stream. Consequently, circulation of an excessive amount of this extract, resulting from an increased function of the gland, operating over a period of years, will rob the storehouse—the skeleton—of calcium and, as a consequence, cause rarefaction of the bones, leaving holes or cysts, as in osteitis fibrosa cystica. In such a process, similar defects in the jaw bones, with consequent loosening of the teeth, might be expected; but it seems that the teeth themselves are unaffected. Albright, Aub and Bauer, and also Hunter, are responsible for the statement that the teeth do not take part in the generalized decalcification. They may fall out because of disease of the jaws, but they themselves remain well calcified. This is brought out strikingly by roentgenograms in which the well-calcified teeth stand out sharply against the poorly calcified jaws. This failure of the teeth to become decalcified is strong evidence against their having a reserve supply of calcium. In this disease, which, by the way, is by no means common, the blood serum calcium which normally ranges between 9.5 and 11.5 mg. per hundred cubic centimeters of blood, is elevated to from 13 to 17 or even 20 mg. per cubic centimeters. Such abnormally high calcium levels are rarely encountered, and I cannot help doubting therefore that hyperparathyroidism is a frequent cause of dental caries. Calcium can be lost from the body in the absence of an elevated blood calcium level. This is seen strikingly in hyperthyroidism, wherein the thyroid gland is excessively active. Enormous amounts of calcium may be lost through the stools in the presence of a normal blood calcium level. Calcium is also

7. Lisser, Hans, and Shepardson, H. C.: D. Cosmos, 78:67 (Jan.) 1936.

lost during menstruation, and pregnancy imposes heavy demands on the calcium stores of the mother. Puberty is a time of rapid skeletal growth and it is reasonable to assume that teeth might suffer during the strain of building the skeleton. Osteoporosis may be associated with tumors of the cortical portion of the suprarenal gland, and, with a similar clinical picture, described by Cushing, may be due to some as yet poorly understood disturbance of the pituitary gland. Underfunction of the sex glands (testes and ovaries) may be accompanied by softening of the bone. That the teeth may suffer and soften and decay under these various circumstances seems very likely. It is obvious, then, that a great variety of ductless gland disturbances, sketched above, may have a deleterious effect on dental structures. The important point to remember is the multiplicity and great diversity of these disturbances, leaving out of account for the moment such other important influences as infections and nutritional disorders with possible vitamin abnormalities. Evidently, then, this is not a simple matter and, in consequence, the therapy of teen-age caries does not resolve itself into the mere administration of this or that endocrine extract. Each case must be studied individually, and, naturally, the only one competent to undertake this is a well-trained physician. Until our knowledge is more precise, we must do the best we can with the facts at our disposal. Even now, provided the dentist and physician cooperate, we can help many of these patients.

MANAGEMENT OF ENDANGERED AND INVOLVED PULPS*

By W. CLYDE DAVIS, A.M., M.D., D.D.S., Lincoln, Nebr.

FOR the mastication of food, nothing quite equals the natural teeth possessed of vital pulps and retained in place by healthy tissues.

Although it would seem that this statement should be universally accepted, the heedlessness with which, many times, such teeth are removed to give place to the artificial causes one to wonder.

ENDANGERED PULPS

The protection and conservation of endangered pulps covers a large area of the field of preventive dentistry. The natural enemies to the dental pulp are bacteria and thermal change. Protect all pulps against both of these extrinsic enemies, and the pulp canal problem will require little attention.

Bacteria may gain access to the pulp either by way of the foramina or through a break in the continuity of its normal covering. Thermal change may endanger a pulp only when much of the normal covering has been removed. This covering of the pulp is most often removed by caries, but not infrequently by filling the tooth.

The normal pulp has no tactile sense, neither is it responsive to thermal change, even though there is considerable variation from body temperature.

When the pulp is robbed of its normal covering and protection, the reverse of the foregoing conditions quickly develops. The sense of touch becomes very acute and any contact with foreign substances

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causes great pain. This is best illustrated when a sound tooth is broken through its crown by a blow, and thus the pulp is exposed. At first, the pulp may be touched with the finger or an instrument without the knowledge of the patient, but, in a few minutes, a touch will cause unbearable pain. Also, at first, cold air does not affect the pulp, but coincidently with the development of the tactile sense comes a sensitiveness to cold.

Fig. 1.—Treatment of upper first bicuspid which had a slightly exposed pulp five years after eruption. The pulp was capped with a medicated cement. Twelve years later, the filling was removed. The pulp canal to the gum line (*A*) was filled with what appeared to be secondary dentin and was normally sensitive, with no pathologic process showing in the apical region. The tooth was refilled.

Fig. 2.—Appearance of lower right second bicuspid which had had exposed pulp covered with medicated cement sixteen years previously, when patient was 30. Recent vitality tests were positive. *A*, canal obliterated to below the gum line.

The chief idiosyncrasy of the pulp is its response to thermal change and especially to cold, when change is rapid or the pulp is in any way hyperemic. A normal pulp will tolerate without response quite a range of temperature when the change is brought about slowly. This is generally the case when the pulp is covered with the full crown of the tooth. But when, through decay or from some other condition, this covering is all or partially lost, the changes are so rapid that the peculiar responsive features spoken of are developed.

The recuperative powers of the pulp have been discussed by many writers. The previous teachings have been that the recuperative powers of this organ are very limited. Recent research has developed the fact that the possibility of repair in pulp tissue is as great as that of repair of the medullary tissue or bone marrow. A pulp responds readily to repair of aseptic wounds of its tissue.

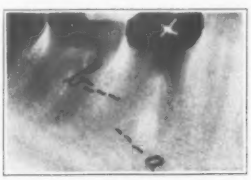

Fig. 3.—Treatment of lower right first molar. At 12 years, the pulp was semiputrescent, and the chamber and part of the mesial canals were filled with medicated cement. A granuloma formed about the apex of the mesial root. The tooth was extracted and sections were made (Figs. 4-5). The pulp canal of the distal root was found to be completely closed with a calcic material from the floor of the pulp chamber to the single foramen. Secondary dentin, pulp nodules, osteoid tissue, a calcified artery and unorganized calcific deposits were found in an inseparable mass.

The indications for pulp protection are not always clear, but will involve consideration of the age of the patient, the extent of the loss of dentin, the location of the cavity in the tooth, the location in the mouth, the length of time the pulp has been exposed, the stage of hyperemia, the general health of the pa-

tient and the possibilities of gross pulp infection.

The age of the patient has a bearing on the successful issue of conservative treatment, as the teeth of the young are more easily saved from further irritation through capping than are the teeth of those past middle age; while, at the same time, they demand capping more frequently under the same conditions.

Again, the pulp should be saved if possible until the tooth is fully developed, and many times the teeth of younger patients are badly decayed and the pulp in great danger before the teeth are completely; hence, if the pulp can be conserved and pulpectomy or amputation be avoided, it is of great good to the patient.

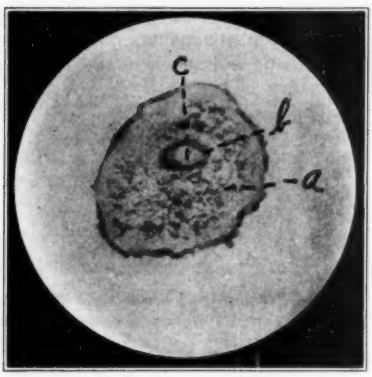

Fig. 4.—Cross-section of tip of distal root of tooth shown in Figure 3. *a*, cementum; *b*, dentin; *c*, closed pulp canal. (×20.)

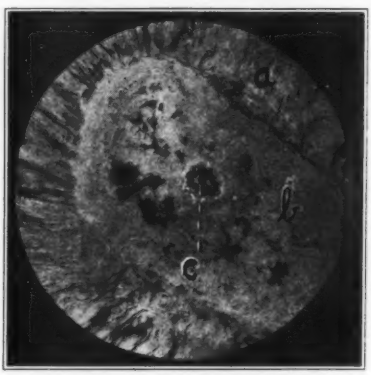

Fig. 5.—Cross-section of midroot. *a*, dentin; *b*, osteoid tissue, remains of calcified artery. (×320.)

In advanced age, the apical openings become smaller and many become contracted, barely accommodating the vessels with a normal flow of blood, so that a very slight congestion may cause death from strangulation or gangrene.

When a large amount of the dentin has been lost, even though the pulp seems normal, it is safe practice to avoid the placing of the best conductors such as gold or amalgam, in close proximity to the pulp. Repeated shocks to the pulp through the filling from thermal change may bring on hyperemia. In the use of zinc phosphate or the silicate cements, there should be an intervening medium to prevent irritation from the phosphoric acid.

The location of the cavity is a factor in the demand for pulp protection, as well as the probability of success in the extreme cases. The first portion of the pulp to show a hyperemic condition is that nearest the point of irritation. Congestion is more dangerous when it appears in the body of the pulp, as it does when decay approaches the pulp in the gingival third. Hence, a pulp nearly exposed in this location demands greater protection and is at the same time harder to save than when the horns of the pulp are involved.

The location of the tooth should be considered. The anterior teeth are subject to greater extremes of heat and cold than are the molars; hence, the demand

for protection of the anterior teeth should be kept in mind. At the same time, their exposed position makes pulp capping more hazardous and it should be practiced with great care in this location. Again, less risk should be taken in capping of pulps in the anterior portion of the mouth as it is better to remove a number of questionable pulps than to have one die in the tooth, with consequent discoloration.

The length of time the pulp has been exposed to irritating influences is to be taken into consideration, as the shorter the time of exposure, the greater the probability of success in capping.

The stage of hyperemia should be a safe criterion where there are actual pulp complications, as there will be in almost every deep-seated cavity. In active hyperemia, from sources other than bacterial, it is safe to protect the pulp from future irritation and insure its conservation. When the symptoms of passive hyperemia have developed, it is not safe practice to attempt to restore the pulp to normal and expect permanency of restoration.

The symptoms of active hyperemia in which the pulp demands protection and successful treatment may be expected are as follows:

1. Exposure of the excavated cavity to the air causes a continued pain of a throbbing nature and the condition is relieved by packing the cavity with dry cotton.

2. A blast of air from the chip blower causes a quick sharp shooting pain, which subsides as quickly as it came.

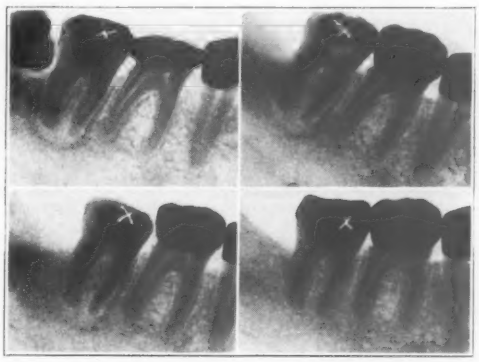

Fig. 6.—Treatment of lower right second molar; case in which medicated cement had been used on infected pulp. All pulp canals became putrescent. Ten years later, the canals were treated for putrescence and a permanent filling was inserted. Above: Left: Appearance before treatment. Right: Treatment with a medicament made opaque with bismuth. Below: Left: Canals filled. Right: Appearance one year after filling. The roentgenogram shows no pathologic condition.

3. The pulp shows the power of accommodation as evidenced by toleration of a draft of cold air when applied gradually.

4. It is improbable that the pulp has become badly infected.

The general health of the patient must be considered in choosing between conservation or the radical treatment of the pulp.

Under the same pulp conditions, for

pulps in the teeth of the anemic patient, wherein the vital processes are at a low ebb and cell metabolism is deficient, protective means of conservation are most imperative; while, at the same time, less risk should be taken.

With robust and particularly plethoric patients, all inflammatory processes run a rapid and riotous course, and when the pulp is hyperemic, the changes toward dissolution are rapid.

In deep-seated cavities, it is probable that the thin layer of dentin covering the pulp is infected and the pulp should be protected from invasion by a thorough disinfection of the overlying dentin through medication, previous to the filling, as well as placement next to the dentin in question and under the filling of a permanent dressing, which will exert a mildly antiseptic influence for some time after the operation.

The requirements of the materials used in protective procedures are that: (1) they be poor conductors of heat and cold; (2) they shall be permanent, as to both consistency and bulk; (3) they have no permanent action on the pulp, and (4) they may be introduced into deep-seated cavities without pressure.

It has been the uninterrupted practice of the dental profession for generations to perform the operation known as "capping the pulp." The only changes which have been made arise from a greater discrimination in the selection of cases. During all this time, medicated cements have played an important part, and all operative dentists have a place for them. There has been a lessened use of those ingredients which had for their object the preservation of flesh and a rise to favor of those which tend toward the normal functioning of the pulp.

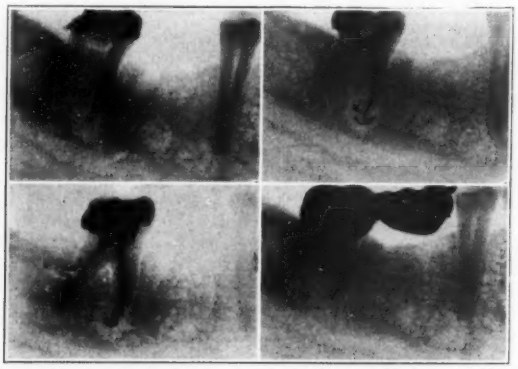

Fig. 7.—Treatment of lower left second molar. Above: Left: Putrescent mesial canals over well-defined granuloma; distal canal containing vital pulp. The pulp chamber was entirely uncovered; a cement partition was made buccolingually across the pulp chamber, and each root was treated as a separate case. Above: Right: Mesial canals and apical region treated for putrescence. Pulpectomy was performed on the distal root and the three canals were given a permanent filling (below, left). Below: Right: Appearance nearly three years after filling of canals. The granuloma at the apex of the putrescent root has been replaced with bone of a seemingly normal density and the tissues below the root on which pulpectomy was performed have remained normal. The molar anterior was extracted several months before this tooth was treated. There are two rarefied areas remaining.

The materials used in these medicated cements at this time are comparatively few, but are compounded in many preparations and sold by the leading dental dealers under a legion of names.

The most used medicated cements, in pulp conservation, contain two or more of the following chemicals, which may be mixed by the operator or secured at a dental depot: zinc oxide, zinc sulfate, crystals of thyme and iodine in one of its many forms.

Some one or more of these are made into a paste with oil of cloves. Water is sometimes added to the compound. Medicated paste is placed over the nearly exposed or exposed pulp or as a dressing on the wound of a pulp after amputation of the pulp horns, or the coronial portion of the pulp, as with deciduous teeth, and with permanent teeth of children having recently exposed pulps and yet undeveloped roots. In the latter case, the tooth pulp will deposit a protecting osteoid tissue near the seat of the wound. (Figs. 1 and 2.)

There are four distinct classes of cases wherein success may be expected in methods of pulp protection. The treatment of each class is given here.

1. In the progressive stage of caries wherein but little dentin has been lost, yet a blast of air from the chip blower causes a quick, sharp pain, passing off as soon as the draft of air is checked, are found the simplest form of pulps demanding protective measures.

This is the class most often neglected by the operator, and many times irreparable injury is done a pulp by placement in such a cavity of a filling of high conductivity, such as gold or amalgam.

The patient often believes that "cold water leaks in about the filling," and may visit another dentist thinking that he has a poor filling. The patient may be lost, by an otherwise good operator through the neglect of what may appear to the operator a trivial matter.

The treatment of the first class is thorough disinfection and the application of phenol, full strength, for a few seconds; when the cavity should be dried, and it will be found unaffected by the blast of air from the chip blower. The change is brought about by the superficial coagulation of the albumin in the exposed ends of the dental tubuli, which renders them nonconductive.

2. If after one or two applications of the phenol, as described above, the distress from the blast of air is not relieved, or if the pain is continuous while the surface of the cavity is exposed to the air, the condition is probably of the second class, as met with in nearer approaches to the pulp. This class demands a medium intervening between the dentin and the filling. All cavities to receive silicate or cement fillings of any make are treated as in this class to prevent pulp destruction by phosphoric acid.

The treatment in the second class is as follows: The cavity is moistened with phenol, which is allowed to evaporate to crystallization or comparative dryness. Then the entire dentin walls are painted with "repelac" or copal and gum dammar in alcohol and ether solution. Such a preparation can be had at the dental depot or it can be prepared by the druggist. It should be thin and spread evenly, one, two or three coats being applied and dried with a draft of air from the chip blower after each coat. When the varnish is entirely hardened, the filling may be placed.

3. In the deep-seated stage of caries, where large quantities of dentin have been lost, even though the pulp may seem to to be protected by secondary dentin and has been retracted, it is not safe to place a filling directly on the overlying dentin.

The lost tooth structure should in a

measure be replaced with a material that is a poor conductor of heat and cold. This should be neutral as far as irritating properties are concerned, and show little dimensional change, and should withstand the force necessary to properly introduce the intended filling.

The treatment in the third class is as follows: The cavity is moistened with phenol and dried, then varnished with the above-mentioned cavity varnish and dried. Over the dentin, covering most if not all of the axial or pulpal wall, or both, according to the class of cavity treated, a thin layer of oxyphosphate of zinc cement is allowed to flow, care being observed not to include thereunder any air bubbles, and is applied without pressure. This is allowed to set to complete hardness, when the filling may be completed. In the three classes described above, it will be noted that coagulation of the protoplasm in the exposed ends of the tubuli was the first step. This is good practice because this layer of coagulum is the least irritant substance (of which we have knowledge) to the remaining protoplasm. Phenol is very limited in its action and this layer of coagulum is very thin. Again, with this third class, it will be noted that, in addition to the use of phenol, the cavity is given a coat of varnish before the application of oxyphosphate of zinc cement. This procedure is to prevent the irritating effects of the phosphoric acid, particularly while the cement is setting.

4. In deep-seated cavities wherein there is a slight pulp involvement from thermal shock and the thin overlying layer of dentin is probably infected to some depth and more deeply affected in the process of caries, the dentin should be subjected to quite a continued disinfecting process and a portion of the lost dentin restored with a poor conductor of heat, to shield the pulp from sudden thermal change.

The treatment in the fourth class of cases is as follows: The softened dentin has been removed. The cavity is then flooded with ammoniated hydrogen peroxide to neutralize the acid of tooth decay which has penetrated the dentin. This should be wiped from the cavity and a pellet of cotton carrying pure aqua ammonia should be placed in the cavity and allowed to remain for one or two minutes. The cavity should then be bathed with hot tap water and again made reasonably dry. By the foregoing procedure, the acids and other end-products of tooth decay and fermentive decomposition are made soluble in water and washed away.

The cavity should then be flooded with a nonirritating antiseptic, such as a preparation of camphor and phenol or oil of cloves. If this is sealed in the cavity for twenty-four hours, the result will be much better. The cavity should then be wiped dry with absorbent cotton and a thin paste of oil of cloves and zinc oxide spread over the dentin overlying the pulp. Over this, a layer of oxyphosphate of zinc cement is spread and is allowed to set hard before the filling is completed.

In very questionable cases, the entire cavity may be completed with cement and the patient dismissed for six months. At the end of this time, if the pulp is found normal, a portion of the cement may be removed and replaced with a more permanent filling material.

Pulp preservers and so-called mummifiers should be avoided. Even their name is misleading, and such preparations are used without permanent success in the majority of cases. Their employment simply proclaims their users as unskilled laggards, who will face an uncertainty to avoid a little honest labor in pulpectomy and canal filling. The entire procedure of attempting pulp mummification cannot be condemned in too severe terms. It is a retrogression in dentistry, unskilled in principle and unwarranted in practice.

Guttapercha as a protecting covering is not a success from the fact of its long range of contraction and expansion under varying thermal changes. When it is enclosed under a filling that is perfectly tight and unyielding, as all fillings should be, the change in bulk must have a piston-like effect on the contents of the dental tubuli, resulting in continued irritation.

In cases wherein the nerve-block method has been used for cavity preparation and there has been a near approach to the pulp, healthy or otherwise, it is the best practice to seal a mild antiseptic in the cavity under a temporary filling for a few days.

INVOLVED PULPS

We are just emerging from the depressing influence of the "One Hundred per Cent" vital enthusiast. The dental schools, with the exception of one or two, are requiring a very much greater number of pulp canal fillings before graduation. The dentists who extract all teeth with involved pulps are largely those who have not given the subject of pulp involvement much attention in the light of present-day methods. We assure those men that the methods now taught are different and the results are as satisfactory as are those obtained in the practice of medicine when dealing with similar lesions elsewhere in the body.

PULPOTOMY

Operation on the pulp, as now taught in most colleges, is giving very satisfactory results.

When a vital pulp gives evidence of being involved past the point of quite certain recovery, it is accepted teaching to practice pulpectomy (pulp removal) on those teeth with fully developed roots with accessible foramina, and partial pulpectomy (partial pulp removal) on young teeth with undeveloped roots or fully matured roots having lateral branches to inaccessible foramina. (Figs. 3-7.)

Neglect on the part of the dentist to protect dental pulps from thermal change, phosphoric acid poisoning and infection is the direct cause of the major portion of subdental diseases with their frequent sequelae.

On the other hand, the same subdental disorders are of rare occurrence after pulp canal surgery and canal filling as now advocated by many research men and taught in most dental schools of America.

CONCLUSION

It is much better to practice pulpectomy and partial pulpectomy in cases of pulpitis due to infection rather than to attempt to salvage the pulp by the use of medicated cement.

The time to use a medicated cement is before the pulp has become involved and while the infection is yet in the dentin.

Those medicated cements which have gone the farthest toward pulp salvage in deep cavities contain zinc oxide or iodine in one of its many forms as a frequent ingredient. Thyme as an aromatic antiseptic has been used in several of those medicaments on the market for many years.

SUGGESTED COOPERATION BETWEEN THE DENTIST AND THE ORAL SURGEON IN COMPLICATED ANTRUM CASES*

By HARRY E. STRAUB, D.D.S., LOS ANGELES, CALIF.

PROMPT and proper care of the many conditions of the maxillary sinus which are of dental origin is essential if we as dentists are to fulfil our obligation and responsibility to our patients. Neglect, whether intentional or otherwise, may have most dire consequences.

Chronic sinusitis has been the bane of many persons. It usually has periodic exacerbations, with intense pain, profuse pus and an excessive formation of mucus, and always a toxemia, which may vary from a low-grade systemic disturbance to an acute toxic load sufficient to overwhelm the host. Chronic sinusitis frequently eventuates in a pansinusitis, which is virtually incurable. Such conditions present a serious drain on the essential vital resistance, predisposing the patient to other bacterial invasion. The sense of well-being is noticeably lessened. There are aggravating head pains and an excessive secretion of foul mucus. Under such conditions, the shortening of the life span is inevitable.

Therefore, as one representing that specialty of dentistry which deals most frequently with these problems, I offer the following suggestions, with the hope that the general practitioner of dentistry may be able to handle such complications with greater satisfaction to their patients and to themselves.

To establish a premise for a logical discussion of this subject, let us group the treatment of the maxillary sinus under six heads according to type of condition: 1. Maxillary sinusitis of nondental origin. 2. Maxillary sinus involvements by accidental opening, not infected. 3. Accidental opening complicated by acute infection. 4. Maxillary sinusitis complicated by the presence of foreign bodies such as teeth, roots and parts of instruments. 5. Acute exacerbations of a chronic maxillary sinusitis: (*a*) removal of polypi and (*b*) radical stripping of the membrane. 6. Neoplasms or tumors within the maxillary sinus.

A maxillary sinusitis of nondental origin arising from an acute rhinitis, or coryza, which congests the mucous membrane of the nasal passages, not only prevents the normal emptying of the antrum, but also infects it. This type of case should be referred to the rhinologist for treatment, because the frontal and ethmoidal sinuses are virtually always involved and need concurrent treatment.

The maxillary sinus that has been opened by an operative procedure, but is not affected by any infection other than that normally found in the secretions of the mouth, is treated by an immediate closure of the mouth end of the opening, first by suturing the available soft tissue, using

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a soft tissue flap if logical, and fortifying this by placing a cork of some material as a surgical pack in cotton over the area (not up into the opening, but over it). The pack is retained by ligation to the adjoining teeth or, if necessary, in the absence of teeth, by placing sutures through the soft tissues. It is then tied to place and molded carefully to the contour of the area, the soft tissues being free from saliva so that it will adhere and the passage of air be prevented and contamination be thus excluded. The patient is instructed that it is essential for this dressing to remain air tight. If it loosens, he should return and have it replaced immediately. After from five to seven days, the dressing is replaced if necessary until sufficient healing has taken place to close the passage to the antrum. If the patient has not been allowed to rinse the mouth or otherwise force the mouth fluids up to contaminate and infect the antrum preceding the placing of this so-called cork, this method will prove most satisfactory and primary healing usually take place. Sneezing, coughing and smoking tend to break the clot by increasing the tension on it and should, therefore, be curtailed as much as possible. Slight traces of blood may be expected via the ostium and nostril for a day or two.

An open socket should never be maintained for subsequent treatment of the antrum.

An acute infection not complicated by the presence of foreign material other than bacteria or blood clot can be successfully treated, not by using the socket, but rather by making a round opening about one-eighth inch in diameter through the anterior face of the malar bone just above the first molar area. An incision about three-fourths inch long is made in the soft tissues of this area just as they curve away from the jaw to form the top of the vestibule. The advantage of this incision is that the wound needs no sutures as it will automatically close under the normal muscle pull. It must be packed to keep open during the irrigation period. Since the antrum is abundantly supplied with nerve tissue and deaths have been reported as resulting from shock due to rough treatment, every effort should be made to minimize the pain attendant on treatment. The solutions should be carefully prepared as to content and temperature to prevent the serious physical shock or injury to the antrum tissue. A tepid physiologic sodium chloride solution is generally used, but when the response is not satisfactory, the use of some other solution may prove beneficial. A variation of the solution aids materially in combating the numerous strains of bacteria that are present. Bacteria may develop resistance to any given solution used continuously. The following solutions have proved effective: chloramine-T, 1:1,000; diluted Lugol's solution, 2 per cent; neosilvol, 5 per cent; argyrol, 5 per cent.

The physical condition of the patient is, of course, a prime factor in determining the prognosis. From three to twelve treatments should usually suffice to clear the antrum. When the antrum is washed clear and all other symptoms are favorable, a two-day period is allowed and a clear irrigation at this time may be considered sufficient evidence to terminate treatment and allow the wound to close. It is assumed that in those cases wherein the tooth socket is involved, the socket has already healed sufficiently to close the opening into the antrum.

Infections that persist longer strongly suggest the presence of foreign bodies, such as roots, teeth, gauze, parts of instruments or other diseased teeth involving the floor of the antrum. The history of the case should be carefully checked

and augmented if possible. The roentgenograms should be studied and others taken if needed. Also, the vitality of all teeth in the field should again be checked and the investing tissues examined for possible sources of infection that might reach the antrum through drainage. If this examination proves negative, another series of irrigations may be made. A competent medical internist should examine, prescribe and institute the necessary treatment to build up the resistance.

Foreign bodies in the antrum should be removed. The opening described for irrigation is enlarged to approximately three-eighths inch vertically by one-half inch horizontally. This usually affords ready access to all parts of the antrum without noticeable injury to the nerves supplying the adjacent teeth. The offending object is located and removed. It is advisable to pack the entire antrum rather tightly to control the postoperative hemorrhage, which would otherwise fill the antrum with a large organized clot, and become a pabulum for bacteria, an acute infection developing about the third day. This pack is removed the second day after the operation. The active bleeding present at this time will determine the amount of packing to be replaced after irrigation of the antrum. The irrigation fluid should flow freely out through the ostium; otherwise, it must be opened or an artificial one be made. This type of case should clear up and be ready for closure after a few treatments, from three to six.

If a low grade chronic infection has become acute and, on examination, the antrum membrane is found to have lost its character and has thickened and polyps are found, these should be carefully removed, and the antrum packed and irrigated. If the tissue has sufficient vitality to respond, a possibly slow, but a gradual improvement will be noted. This type is not allowed to close until there is reasonable certainty that resolution has taken place.

If the foregoing treatment fails, it will be necessary to strip out practically all of the antrum membrane. Subsequent resolution will, of course, be retarded, and this operation should not be used except as a last resort because the antrum never again attains normal function or the same degree of resistance to infection as when the original columnar ciliated epithelial membrane lined the antrum. The scar tissue which forms the new lining is not capable of performing these functions because the columnar epithelium which eventually may cover it does not contain mucus secreting glands or the cilia which afforded protection to the original membrane.

Neoplasms or tumors of the maxillary sinus are of numerous types, but are all characterized by the compact mass of tissue which may not only completely fill the antral cavity, but may also have grown sufficiently to cause a distortion or protrusion of the facial, orbital or palatal tissues. The prognosis in these cases is most unfavorable and the patient should be referred at once to an oral surgeon dealing with this type of case, for immediate diagnosis and treatment. As the end-results are most discouraging and frequently fatal, we as a profession have a great responsibility in the matter of recognizing these conditions as early as possible, thus increasing the possibility of a successful treatment.

Where a tumor is suspected, a biopsy should be made. In taking a specimen for biopsy, not only the diseased, but also the healthy tissue of the area should be included. It should be placed in a 3 per cent solution of formaldehyde and sent to a pathologist at once. A sarcoma should not be disturbed unless conditions permit

an immediate biopsy to be followed by an operation if indicated.

It would be a mistake for many general practitioners of dentistry to undertake some of the steps just outlined for the care of conditions of the maxillary sinus. Unless a dentist is doing a considerable amount of this type of work and is properly equipped, there are many conditions that enter in to interfere with a prompt and satisfactory result. Probably all of the oral surgeons and exodontists attending this meeting have been trained to make inlays and bridges, but if you were in need of such a restoration, I feel sure you would not choose one of them who has had no direct contact with such work for a considerable time to perform the operation. For the same reason, it is logical that most dentists should feel that they can best fulfil their professional obligation to their patients by referring antrum cases to a competent oral surgeon. Let us, therefore, assume that a general practitioner has a patient that has developed an antrum complication, and outline a logical procedure:

When possible, where an antrum complication is anticipated, much trouble and loss of confidence may be avoided by referring the case to a specialist.

When the antrum is opened in the noninfected case, rinsing is forbidden and cotton or gauze is immediately placed in the mouth end of the opening, a saddle of compound is made and the case referred for immediate attention. All roentgenograms, extracted teeth or parts of teeth, broken instruments, etc., are sent to the specialist together with information that will aid in making a correct diagnosis of the condition. Such data are absolutely essential for proper treatment. A woman who was definitely instructed to account for the gauze dressing, to save it and return it to the dentist if it came out, swore that she had recovered and burned it, as did her daughter. The antrum would not clear after more than thirty days' treatment. She was continually quizzed regarding that gauze pack, always with the same result. She left for New York and, after three months of unsuccessful treatment, she finally confessed and submitted to the necessary operation for the removal of the gauze, which had been continuing the infection.

It is just as essential for the dentist to be truthful as for the patient. When a complication develops, the issue must be faced at once. A frank and honest statement to the patient, while it may be embarrassing to you, will usually gain his cooperation. A person of average intelligence can usually understand, after seeing a few roentgenograms showing the variation found in this area, that you are not responsible for the manner in which nature saw fit to relate the antrum and its associated structures. Such complications may occur even in the most capable hands. When the patient feels that the dentist is doing his utmost for his welfare, he is appreciative. Many cases have gone to court and resulted in heavy judgments against dentists, not because of the operative procedure, but because the patient was not truthfully informed and directed that proper care might have been given. The opening of an antrum does not necessarily establish that the dentist is to blame. We should, of course, endeavor to perfect our diagnosis to the extent that we can predict and take the necessary steps to best care for any antrum complication that may occur. Under all circumstances, the operator should tell the truth and suggest the necessary steps to place the patient in competent hands. If the patient refuses to cooperate, a careful note of your procedure should be made on the record card, with a witness if possible. The patient is

given a definite warning of the possible consequence if the case is not properly and promptly treated. The attitude of the patient should be made known to the oral surgeon to whom the case is referred, because much can be done by a few well chosen words to ease or correct an unpleasant situation. This point alone frequently determines whether there will be a law suit. The dentist should not lie to patient or surgeon and expect the latter to cover it up. His legal responsibility in the case necessitates the truth; he can only cooperate with you on this basis.

Arthur L. H. Street, LL.B.,[1] writes:

Under a statute requiring a malpractice suit to be brought within a certain period after accrual of the right to sue, the Louisiana Court of Appeal decided that the time for suing a dentist for failing to extract broken roots left in their sockets dated from the patient's discovery of the fact that they remained and not from the time the defective extraction occurred.

On an issue as to whether or not the roots were left, not by the defendant, but by another dentist who had treated the patient many years before, the court upheld a finding against defendant on a theory that since the patient did not suffer until after defendant had treated him it was a legitimate inference that it was defendant who was at fault.

It will be seen from this court decision that a dentist who fails to tell the truth practically places himself in perpetual jeopardy as to legal liability.

Not only tell the truth, but be sure to give the oral surgeon to whom you refer the case all possible information that will in any way assist in the successful treatment of the case. Overdo this rather than allowing your embarrassment to conceal essential information.

1. Street, A. L. H.: Dental Jurisprudence, D. Survey, 12:220 (May) 1936.

ACUTE ORAL INFECTIONS—WHEN NOT TO EXTRACT TEETH*

By A. L. FREW, D.D.S., Dallas, Texas

IN the presence of acute oral infection or soreness of any of the soft tissues, we should proceed with caution, for it may be a beginning cellulitis, Vincent's infection, gingivitis, osteomyelitis or other grave infection that would only need a little encouragement to develop into a serious condition.

One of the most common conditions that we meet is the partial eruption of a lower third molar with the overlying gum flap that conceals a pocket to the distal part of the crown and makes an ideal breeding space for infection. When such a case presents soreness and swelling, I never extract the tooth. Instead, I use palliative treatment to relieve the soreness and swelling, which generally takes several days, and then remove the tooth.

In treating these pockets underneath third molar flaps, I find that tincture of metaphen applied with an applicator and pumped well back underneath the flap, with hot moist epsom salts compresses applied to the outer surface, will, in a few

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days, get rid of the infection and soreness, and make it safe to remove the tooth. I know of several cases wherein third molars surrounded by painful swelling have been removed, cellulitis and death resulting.

In a recent case of advanced pyorrhea with acute soreness developing in the soft tissues surrounding the lower anterior teeth, immediate extraction was advised. The soreness continued to grow worse, developing into an acute osteomyelitis, which caused the loss of all the lower anterior teeth and much of the anterior part of the mandible, with the usual extra-oral pus discharge. No doubt, this condition would have developed had the teeth not been extracted, but had the extraction been delayed a few days, until the acute osteomyelitis had been diagnosed, the patient would have been convinced that the osteomyelitis was not caused by the extraction. This patient's mental attitude was such that the dentist in charge was glad to carry the case to completion without financial recompense. In other words, a malpractice suit was threatened. A few days of watchful waiting would have saved this dentist a lot of gratuitous work. I never extract teeth if there is present an acute Vincent's infection or an acute painful swelling of the gum or mucosa.

In acute cellulitis or other soreness and swelling of the jaws and face, I never use cold applications. I always use heat, preferably hot magnesium sulphate compresses. Heat promotes the circulation in the surrounding tissues and will either bring the congested area to suppuration, if the infection is virulent enough, so that it can be drained; or, if it is a low-grade infection, the increased circulation will more readily reduce the congestion. Cold has the opposite effect on the circulation, keeping the congested area in a static condition.

In my judgment, the old theory that cold applied to the outer surface will keep an abscess from pointing to the outer surface has very little significance. I believe that the sooner we are able to localize the pus and establish drainage, the safer we are from the standpoint of general systemic absorption. In these cases, when it is apparent that the pus will have to be reached through the outer surface, we must not wait until the pus has burrowed its way through to the outer surface; but should nick the skin with a sharp scalpel, then with a pair of fine-beeked hemostats, make a blunt dissection through the muscular fiber to the pus pocket to obtain drainage. If a healthy layer of muscular tissue is left immediately under the skin, the condition will clear up and leave a smooth scar instead of the deep-pitted scar that remains when an abscess is allowed to burrow its way to the outer surface.

Any lesion or painful swelling in the oral cavity for as long as three weeks should be very thoroughly investigated for there is a possibility that it may be a beginning malignancy, and we as dentists should be the first to make these discoveries instead of permitting the physician to make the diagnosis.

Experience has taught me that it is unwise to hastily dispose of a fracture of the maxilla or the mandible. These conditions are rarely seen by the dentist before from twelve to twenty-four hours after the fracture has occurred, and, by that time, there is much swelling, soreness and shock. In many of these cases, several days are allowed to elapse before any attempt is made to reduce the fracture; which permits any lesions that might be in the skin to heal, and much of the trauma and swelling to subside. At the same time, nature will establish a secondary defense of the injured parts that will make reduction of the fracture safe.

Acute pulpitis results in death of the nerve and the usual acute alveolar abscess. Infection of the bone of the jaw follows quite closely that of other bones of the body, save that the infection spreads from the pulp of the tooth rather than being brought to the bone by its nutrient artery. The first change is not discernible on the roentgen-ray film, being merely a slight haze in the haversian canals, showing as slight widening of the shadows of the bone trabeculae. The next stage is death of the infected bone, which gives no definite picture, but shows a little change in the clinical picture. Within from a week to ten days after the original infection, there is some liquefaction of this dead bone, which shows on the dental film as an area of increased transparency, often with sufficient thickening of the surrounding bone to form a barricade against further spread of the infection, and the desired result of completely limiting the disease. At this time, it is safe to undertake operative procedure, which should not extend beyond this barricade of lymphatic cells and normal bone. In other words, an acutely infected alveolar process secondary to death and infection of pulp cavity does not give roentgen-ray evidence of its dimensions until a sufficient time has elapsed for nature to erect a barrier against further spread of the infection beyond the destroyed bone. In my opinion, until we have permitted nature to erect this barrier, meddlesome operative interference will cause bone destruction many times greater than would have resulted from sensible, watchful waiting.

The only time I extract the so-called "aching tooth" is when that tooth has a freshly exposed pulp and there is no apical involvement.

IS IT NECESSARY TO REPLACE MISSING TEETH?*

By B. B. McCOLLUM, D.D.S., LOS ANGELES, CALIF.

BROADLY speaking, the problems of health service may be divided and discussed under three main headings: 1. The production of healthy disease resisting bodies. 2. The administration of remedies to cure or help the body return to a normal, healthy state when it is attacked by disease or to intercept the progress of disease by early detection and proper treatment. 3. The surgical sacrifice of a part of the body that has become hopelessly involved in order to obtain comfort or to prolong life.

The first division, the production of a healthy disease-resisting body, is attracting a great deal of headline attention. We hear, on every hand, of theories and practices that are calculated to bring forth children that are normal in every respect. Eugenics, the science of producing normal children, deals directly with the laws of inheritance, the transmission of good physical and mental qualities for the betterment of the human race. No one can deny that the child born of good stock is better fitted to grow into a healthy man or woman than one born of defective parents. But with all our knowledge of inheritance, we cannot profit greatly as human beings from the

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science of eugenics. The reasons are quite obvious. We probably can never devise a plan to control the reproduction of human beings. Society is not, and no doubt cannot be, organized in that way. But our knowledge of the laws of inheritance can teach us what to expect in given cases, and much can be done from this knowledge to mitigate and, in many instances, eliminate the failure of nature to give the individual an equal chance with his fellow members of the community. Inheritance is the one great determining factor in how we shall grow up, and how long we shall live. Of course, anybody may be the victim of unavoidable disease or accident, but, after all, the general groundwork of our state of health and our longevity is laid in our inherent qualities. Some wag has said, "Select your grandparents with great care"—a profound truth spoken in jest. It should be the birthright of every human being to be conceived for good health and long life. But, failing in this, we must do the next best thing; make the most of our good qualities and indemnify ourselves by external or artificial means as much as possible for the deficiencies.

It is a fact that most of us by birth are not fully equipped to cope with our environment. Animal research has shown that deficient physical stamina, lack of resistance to disease or any similar condition can be greatly compensated by early recognition of deficiencies and wise administration of health measures. Therefore, the services of competent physicians and dentists are necessary to the average person's full enjoyment of reasonably good health. The experiments on dogs conducted at the Cornell Medical Center most graphically portray the results of inherent qualities, and why and how a health service may be necessary for those inheriting a deficient makeup or the tendency to be attacked by certain types of disease, if they are to live free from discomfort and pain, and enjoy life generally.

The sciences of dietetics and hygiene deal with the measures that promote health, growth and development. From the moment the spark of life is started, this knowledge is of paramount importance. Proper food and hygienic conditions are essential to health, not from the cradle to the grave, but from the time of conception to the last breath in our bodies. So important are diet and hygiene that many dentists and physicians have made a fetish of their administration. Efforts are made to feed, vitaminize or endocrinize human beings into perfect specimens of health and strength. All our ills, aches and discomforts are accounted for on the theory of deficient or improper diet. This would not be so bad if it were not for the fact that the overzealous administration of diet, sunshine and the extracts of the ductless glands brings about a neglect of the application of proper remedial or restorative measures. This is particularly true in dentistry, because the teeth lack any ability to repair or replace themselves. The diseases of the teeth are insidious, "working havoc by slow and stealthy means." There are no natural processes of recovery.

An adequate diet and hygienic surroundings are obviously essential to growth and development and the maintenance of health in any animal. Man is no exception. This applies to every tissue of the body, and more especially to the highly specialized tissues of the teeth. But it is quite apparent to the scientific observer that few, if any, people are inherently constructed to fully escape the ravages of dental disease even while under the most rigid system of diet, vitamin intake, exercise, elimination and the best of general body care.

The inability of the teeth to heal themselves makes it necessary that dentistry greatly concern itself with the second division of health service; namely, the science and art of administering remedies to cure, compensate for or intercept the progress of disease. I have no idea of depreciating prenatal or postnatal care involving diet, sunshine or general hygiene in order to promote normal growth and development and to maintain health. Whatever is accomplished along that line is of inestimable value. The robust, disease-resisting individual represents an ideal to be sought, even though little hope can be held for its consummation. This would be disease prevention of the most desirable order. Health could then be distributed by tracts containing the necessary advice and all would be well and without the need of doctors. But, as stated before, it is probably impossible even to approach this ideal condition. In face of the facts, dentists must be made to realize that the basic concern of all those engaged in health service (dentists, physicians) is to administer to the needs of people who are in poor health. If it is possible to detect and eradicate or cure the condition before the patient is himself aware of its presence, health service then reaches its highest value and makes what might be called the nearest approach to a really preventive service. This is not an impossible approach to the problem, and it only remains for dentists and physicians to equip themselves with the necessary knowledge and to develop the ability to detect and correct the incipient or potential disabilities before they have done irreparable harm. In other words, the early interception of disease processes is what a true health service demands in order to afford protection from the ravages of disease.

It would not be amiss at this time to consider briefly the analogy of our efforts to the prevention and extinguishing of fires. The primary purpose of the fire department is to put out fires, yet we expect to learn from them out of the wealth of their experience how not to have fires. It would be possible for men to construct fireproof homes, office buildings and factories, and thus completely avoid fires and the necessity for firemen. But such a course is as practically impossible as it is to produce human beings that are disease and accident proof. Under these two circumstances, all that can be done is to exercise constant vigilance to mitigate the danger or damage of fire or disease by teaching people to avoid fire or illness, and to have trained people ready to respond instantly in the time of trouble, with efficient means to save endangered property or health. The fire inspectors insist that we observe certain regulations in our structures, and if such things as trash or easily ignited material, faulty flues or faulty wiring are found, we are compelled to eradicate the source of danger. Up to the limit of its authority, the health department has a similar duty. In case of fire, we repair the damage by calling on our reserve in the form of insurance or capital to replace the loss. If an illness does not exceed our health reserve, we may return to health. If reserve is lacking in either case, we suffer a loss and cannot regain our former state. In some instances, the firemen must resort to "surgery" and destroy a part, or the whole will be lost. As a final danger, a conflagration may result from a tiny fire, then all is destroyed without hope of recovery.

The avoidance or prevention of fire is the ideal situation, but suppose tomorrow we were informed that our firemen had turned their thought in the main part to fire prevention and were little interested in knowledge, skill and equipment calculated to be used to extinguish fires.

Knowing as we do the unavoidable probability that any of us may suffer a fire, always unexpectedly, we should be up in arms for a new fire department.

Those engaged in health service are confronted with a similar situation. So much attention has been focused on theoretical and visionary disease prevention activities that physicians and dentists are liable to find their places taken by a group of men and women who, though poorly equipped are catering to those in distress. Yes, let us have prevention in a big way, if, at the same time, we can keep ourselves prepared to respond to the needs of sick people, many of whom are below par.

"Dentistry (with a biologic basis) is the art of maintaining the highest possible physiologic oral condition in human beings by the application of all known scientific methods and processes." This, I am sorry to say, is not the dictionary definition of dentistry. But do you not agree with me that it should be?

Dentistry has an unmistakable opportunity confronting it. With the highest possible health and function of the mouth as the basic purpose of dental therapy, and a system of education that will make possible the achievement of this aim, dentistry can, in a few years, make itself appreciated as one of the most important factors of the healing arts—a determining factor in the health service of every community.

In order to attain this goal, dentistry must make scientific diagnosis the foundation of all dental endeavor. By diagnosis, I mean the detailed and minute determination of the physiologic and pathologic conditions of the masticating mechanism for the purpose of intercepting pathologic processes or eliminating conditions conducive to disease or injury, as well as for the purpose of instituting treatment for the cure of established disease or deformity.

Diagnosis is often, perhaps very generally, confused with treatment planning, especially in the minds of dentists. A plan of treatment should follow and be dictated by a diagnosis, and can by no stretch of the imagination take the place of it. In other words, the decision to place a fixed or removable bridge, determining the form of retention or the outline of the appliance, choosing gold, amalgam, cement or porcelain as a restorative agent, deciding to extract a tooth or teeth or persuading the patient to buy a metallic base for a full denture instead of vulcanite or one of the new plastics is not a diagnosis, but is treatment planning. As definite knowledge as possible as to what is right or wrong with the mouth and the etiology of the trouble should precede and direct any plan of treatment, or the dentist will find himself merely in the position of prescribing a technic, all of which has led us into the inexcusable error of calling on the dental technician to help us make a so-called "dental diagnosis."

Considerable agitation has filled the pages of our journals urging dentists to charge for consultations. Isn't it doubtful that many of the examinations or consultations result in any more than an attempt to sell the patient something by an exhibit of models or samples or a presentation of doubtful reasons for having some dental work done? The casual discovery of extensive caries or well-marked disease of the periodontium, or the noting of missing teeth and the possibility of placing a bridge or partial plate, constitutes the usual effort to diagnose the patient's mouth condition. Incipient disease is completely overlooked so that little or no effort to prevent extensive involvement is attempted. But, worst of all, the biomechanics of the mouth is completely overlooked and ignored. A misrelation of the parts of the chewing apparatus has

to be so bad and the injury so far advanced before the damage is noted that repair or cure is in many cases practically hopeless.

Without the knowledge or ability to make a diagnosis, the dentist sees a distressing condition, and having read about or seen clinic appliances and technics recommended to cure what he believes to be the need for "mouth reconstruction," he proceeds to attempt the application of remedies far beyond his knowledge and skill to fabricate. Laboratories invite him to submit his problems, and further complicate the condition by offering advice that can be nothing but detrimental. Attention is called to this tragic shortcoming not with the intention of criticizing the struggling dentist, but to impress on him the necessity for properly informing himself. The knowledge and technics involved in dentistry call for the ultimate in intellect, and dentistry if properly taught would be one of the most intellectualizing courses of study to be offered by any university, calling as it does for knowledge about all the major sciences and arts. This knowledge is not beyond the ken of any person fit to be licensed for the practice of dentistry. Dentists should be willing to so prepare themselves that when they listen to a scientific discussion of dental problems, they do not go away saying, "That is away over my head."

The plain truth is that dentists do not recognize the dental apparatus as an organ. They do not see that the chewing mechanism is anatomically conceived as a symphonic physiologic unit, rhythmic in its movements, and in health coordinated in all its parts. It is really a group of reciprocal members, some of which are in themselves organs like the tongue, taste buds and salivary glands. It is the function of the mouth that reveals the anatomic unity of its make-up. This unity in function depends, of course, on the health and proper relations of the various components of the mouth. To conceive this unity in function demands an understanding of jaw relations as a foundation of oral physiology.

As the dentist's knowledge of the biomechanics of the mouth increases, dentistry will be able to intercept more and more of the retrograde changes due to defect or malrelation of the parts, so that the health and function of the mouth can be protected, with resultant benefit to the general health, well being and longevity. It is a general and fundamental principle of medicine that the way to be healthy is to discover in their incipiency the things that make us ill, and to intercept the disease processes. Dentistry can do all of that, when it learns why and how.

Physicians generally, and I fear many dentists, believe that all the diseases of the teeth could be cured with the forceps, if looks were not involved. In fact, the dental profession has established no biologic reason for dentistry, which is, in the main, practiced as a cosmetic art and utility, and with no real thought as to its metabolic value.

Dentistry's bid for recognition as a health service has been made through the elimination of infection by the extraction of teeth. Surgical interference to rid the body of hopelessly involved parts is certainly justified, but such a service is negative in most of its aspects, and to leave the mouth mutilated from the loss of teeth is anything but a health service and will sooner or later have serious consequences. Only as a last resort should dentistry be concerned with the third division; namely, the sacrifice of part of the body to obtain comfort or prolong life; and then, having at hand the restorative remedies to repair the damage, should apply these remedies as soon as possible.

There appeared in THE JOURNAL, in an

article on medical and dental practice, this statement[1]: "A discussion of dentistry and digestion cannot close without reference to the thousands of toothless people who have good digestion and live to a ripe old age." I cannot help wondering whether the dentist or physician making such a comment is not entirely lacking in the power of observation. That the human body can tolerate many deficiencies and mutilations and still retain the spark of life is amply demonstrated every day. Thousands of people exist to a ripe old age minus one or several of the parts or functions necessary to the full enjoyment of life. (I can't help wondering whether the phrase "ripe old age" is not a fitting term.) Man is a human being only when he is living at full capacity, participating in enjoyable, useful social correspondence, unabashed by deficiencies and burdening no one with his infirmities.

By the same sort of observation, dirt and filth are good for children, reckless abandon is the proper course in our traffic problems and the use of any sort of antiseptic, germicidal or cleansing precautions are useless and silly in surgical procedures.

It is obvious that the ability to masticate well depends on the presence of teeth, but it evidently isn't so obvious that the maintenance of the highest state or oral health is dependent on the presence of sound teeth properly related to each other and rightly correlated to the motions of the mandible. There can be no doubt that the mouth maintains itself in the highest state of health when the biomechanical forces in the mouth are most harmonious. Neither can there be any doubt about the assertion that the mouth destroys itself when its parts are missing or misrelated, either by accident or by nature, and, much as I regret to say it, as the end-result of poor dental practice, which, in spite of its harmfulness, is comfortable and satisfactory to the patient. This principle should be the basis of every dental effort. Don't allow the mouth to ruin itself when remedies are at hand.

A mouth with one or more teeth missing may chew food almost as well as though equipped with a full complement of well alined teeth; that is, well enough to insure proper metabolism; but it does so at the expense of its own physiologic integrity. The moving and drifting of the other teeth following the loss of some of the teeth is accompanied by pathologic consequences just as any other organ of the body is injured by defects in its organization. A defective heart may pump the blood quite effectively and satisfactorily as far as the rest of the body is concerned. That is why the patient may be entirely unconscious of any heart disease, but it does so at the expense of its own well being. It cannot be repeated too often that a defective mouth may chew the food, just as a defective heart may pump the blood, but the pathologic processes of disintegration are in principle the same in both instances. As the defective heart, in a spectacular manner, eventually destroys itself and the rest of the body, it should be apparent to dentists that a defective mouth destroys itself, and, while not so spectacularly, as surely destroys the rest of the body.

In an unpublished article reporting experiments with rats at the Yale Medical School, Bert G. Anderson writes:

> The extraction of the upper right first and second molars was associated with a lack of attrition of all the cusps of the lower right first molars and the mesial cusps of the lower right second molars. The cusps of the upper right third molars were markedly shortened by wear. Lesions

1. Williams, J. B.: Interrelationship of Dental Practice and General Medicine, J.A.D.A., 23:742 (May) 1936.

associated with the fracture of irregular dentine were seen only in these cusps shortened by wear in the teeth of rats fed a low-salt diet. Changes in the pulps were particularly marked in the lower right first and second molars. Structural alterations of the alveolar processes and ulcerations with necrosis of the gingivae were marked on the right side. Slight changes in the pulp and gingivae were also seen on the left side. The changes of the pulp tone and gingivae were more severe in the rats fed a low-salt diet.

The fact that those changes were seen only in rats with the upper right first and second molars extracted indicates that the removal of these teeth was largely responsible for the occurrence of the changes. This study emphasizes the far-reaching effects of alterations in masticatory stress and strain.

This is experimental evidence of the effect of absence of teeth. We can hardly point with pride to the fact that as far as is recorded in literature, and this is not yet published, this experiment is the first of its kind. Dentistry is asleep at the switch and has allowed the whole train of biologic thought to be wrecked by a lack of a biologic concept. The benevolent effects on the general well-being of those who have had the function of mastication restored is the clinical proof of the health benefit of such treatment. It is as good proof of the value of the treatment as any medical problem offers as a clinical observation.

The discussions in this article and the thoughts expressed are the result of the work of the Gnathological Society. "Gnathology is the science that treats of the biologics of the masticating mechanism; that is, the morphology, anatomy, histology, physiology, pathology and the therapeutics of the oral organ, especially the jaws and teeth and the vital relations of this organ to the rest of the body."

Some of our principal studies have been confined in the main to jaw relations because we believe this problem to be the one that forms the basis of all biologic concepts of the mouth, the foundation of knowledge for a gnathologic diagnosis, or a real dental diagnosis, if you prefer to call it dental. Without a knowledge and record of jaw relations, it is impossible to study the biomechanics of the mouth, and who would have much respect for a heart specialist, for instance, who did not learn all he could about the biomechanics of the heart and who did not resort to every available method and instrument to acquaint himself with his patient's heart condition? We can understand the physiology and pathology of the mouth only as we are versed in a knowledge of its biomechanics.

By every inference at my command, I have tried to show the necessity for replacing missing teeth. No branch of dental service is more important, because the need for tooth replacement may be apparent until after a long lapse of time and then irreparable damage has been done. The mouth and the teeth, acting as anchorages, accept well-fabricated replacements to a most gratifying degree, but every dentist knows that nothing can actually take the place of a natural tooth.

EXPERIMENTAL RESORPTION AND REGENERATION OF DENTO-ALVEOLAR TISSUES*

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, Calif.

ROOT resorption is neither a newly discovered disease of teeth, nor is it confined to the human being alone. Sir John Tomes,[1] in 1859, describes absorption (resorption) of roots of permanent teeth as follows:

> The crown of the tooth is quite intact, but the root is deeply excavated, and the pulp-cavity contains a large mass of secondary dentine which is continuous with the normal dentine where it touches it; it is impossible to say at what period this mass was formed, whether before or after the root had been attacked by absorption from without, though it would seem probable that it was an attempt on the part of the pulp to defend itself, as it exactly corresponds to a deep excavation on the outside of the tooth.
>
> The exterior of the root presents an excellent example of that alternation of absorption and deposition which is so common where irritation has long existed.
>
> A somewhat similar result may follow on the exposure of the pulp by the wearing down of the dentine until the pulp has been quite or nearly exposed. In the human subject relief will have been sought before things have gone on to their ultimate sequel; but in the lower animals instances are now and then met with in which a long time has elapsed without the tooth being shed, as is exemplified in the teeth of a grampus in the Oxford Museum, in which, owing apparently to a twist in the jaws, all the teeth of one side, in place of interdigitating, came to be exposed to destructive attrition, with the result that their implanted portions were enlarged and absorbed in an extraordinary way.

His observations, nearly 100 years ago, on the clinical aspects, have been complete enough to stand the searching scrutiny of the present day. Although the roentgen rays were unknown, the lack of them was probably compensated for by much more careful clinical examination than is now the custom. The foregoing description of root resorption is clearly a case in point. Tomes also mentions that root resorption of deciduous teeth need not necessarily be a continuous process. In fact, the lost portion of the root may be replaced by osseous tissue. Microscopic sections demonstrating this fact were presented several years ago, but their significance was perhaps overlooked.

There are present, I believe, some who have followed rather closely the experimental work conducted under the auspices of the Pacific Coast Society of Orthodontists, the American Society of Orthodontists and the Board of Research of the University of California and reported in a preliminary communication at the twenty-eighth annual meeting of the American Society of Orthodontists at Estes Park, Colorado, July, 1929. The questions which were asked at that time were as follows:

1. In what proportion of orthodontic cases does apical resorption occur?

*Read before the Section on Orthodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

1. Tomes, John: Dental Surgery, Philadelphia: P. Blakiston & Son, p. 432.

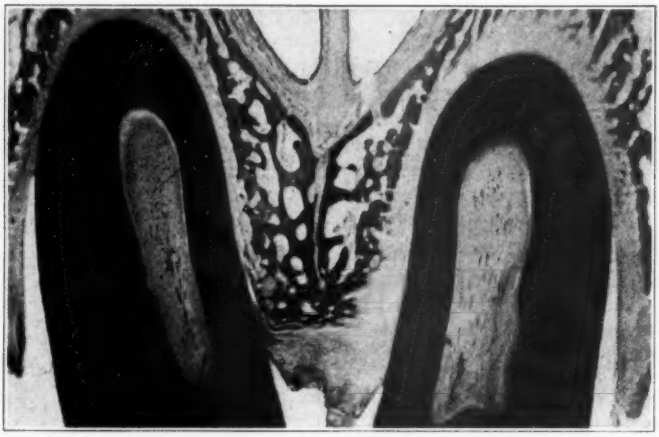

Fig. 1 (Monkey 119).—Effect of intrusion and extrusion pressure on peridental membrane surrounding roots of permanent central incisors. The tooth on the right has been slightly extruded from its socket. (Hematoxylin and eosin stain.)

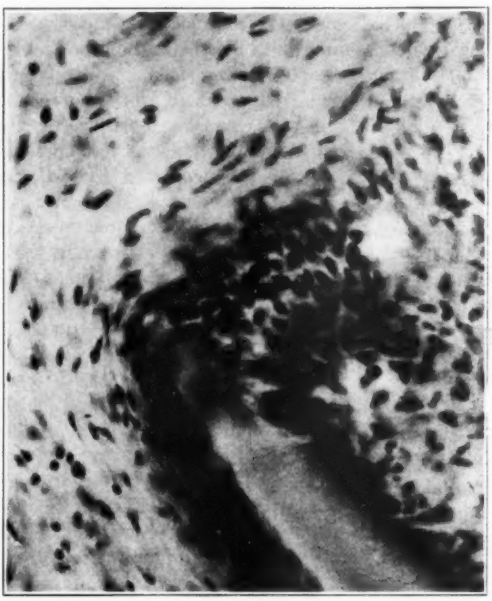

Fig. 2 (Monkey 119).—Apex of left central incisor. The intrusion pressure compressing the peridental membrane against the bone has produced leukocytic infiltration. (Hematoxylin and eosin stain.)

2. What relation has this occurrence to the duration and type of previous orthodontic treatment, and what is the relation to those cases where orthodontic interference has never been attempted? To put it more concretely, how often does apical resorption occur in cases where orthodontic treatment has never been followed?

3. Which factors are the more important in favoring the development of this condition: the local ones, as represented by the phrase "unusual mechanical stress," or the general ones, grouped for convenience under the term "systemic causes"? Furthermore, if an unusual mechanical stress is responsible, in what way does it operate and how may it be avoided? If the whole system is at fault, in what direction does this fault lie, and what procedures are indicated to correct it or to avoid it?

It is perhaps apparent to certain of you that answers have been proposed to all of these questions. Whether they are the correct answers will remain for a succeeding generation to determine. The therapy which has been suggested alike by obstetricians, pediatricians and orthodontists requires a generation to demonstrate its value or its worthlessness. Our immediate concern deals less with the type of appliance used than it does with the patient who is being treated. There are two conditions favoring root resorption, and of these two the one of greater importance is the general health. Attention has been called repeatedly to the laboratory observation that animals in a state of good health respond more favorably to orthodontic treatment than do those whose dietary or nutritional standard has been deliberately lowered. A phrase which has been oft repeated in connection with infectious disease applies with equal force to the changes produced with metabolic disease, such as the various avitaminoses: "It is more important to know what sort of a patient has the disease than to know what disease the patient has."

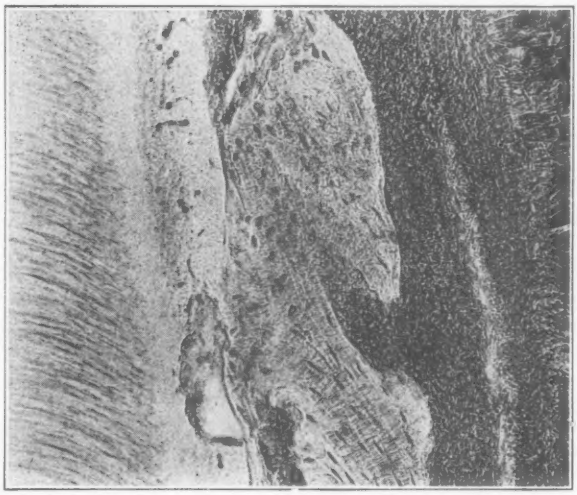

Fig. 3 (Monkey 183).—Cementum and bone in direct apposition; resorptive processes developing in both tissues. (Schmorl stain.)

The case history and family history frequently throw light on prognosis, and also may modify the method of treatment.

There is, at least, one part of the problem which is gradually being developed satisfactorily. The diagnostic methods of

No two persons react alike, any more than any two monkeys, or two rats or two cats. Each shows individual characteristics. So with clinic patients: no two are alike; no two respond equally well to methods of treatment. As a measure of protection, therefore, the orthodontist

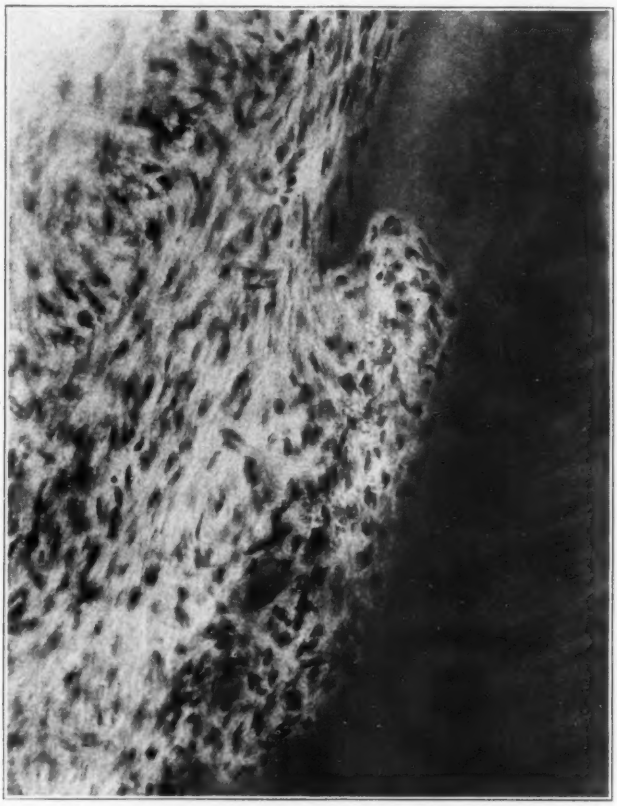

Fig. 4 (Monkey 379).—Resorptive process on left lateral incisor. Hematoxylin and eosin stain demonstrates the degree of inflammatory reaction present.

today are probably farther advanced than they were ten years ago when this subject of resorption intruded itself as a specter at the "orthodontic feast" of molar bands, lingual bars and hooks.

should well acquaint himself with the standards of health used by the pediatrician.

Emphasis has also been laid on the fact that growth processes are not of steady

increment, but rather occur in three general stages. This has been described in detail on previous occasions. It is quite probable that skeletal growth and dental development proceed at nearly the same rate. The factors which favor or hinder the one affect likewise the other. One

the same time. When an infectious disease develops, especially one of the exanthems, the growth rate is reduced. The same effect is produced, likewise, by metabolic disease or an unfavorable nutritional régime.

As an example of the delay in erup-

Fig. 5 (Monkey 379).—Bone surrounding developing permanent canine. (High magnification; Schmorl stain.)

may expect that the normal resorption of deciduous roots, as well as the formation of the permanent teeth, parallels the skeletal growth and occurs probably at

tion of teeth occurring in animals on deficient diets may be cited the following: Two dogs in a litter were placed on a rachitogenic diet. The third was given

CHRONOLOGIC TABLE ON RESORPTION

Monkey No.	Time Appliance Was in Place Days	Diet	Histology
119	1	Special	Slightly hyperemic pulp and peridental membrane
299	11	Regular	Right and left central and left lateral incisors: inflammatory reactions in pulp and peridental membrane; no evidence of resorption
121	37	Special	Extensive inflammatory changes in apical region; on left central incisor, deep resorption near apex on palatal aspect of root; hypoplastic dentin matrix; extensive hyperemia throughout bony structure
2	50	Special	Deep pressure resorption with only slight amount of apposition; elongation stress which has pulled bone trabeculae into position parallel to long axis of tooth; new bone formed slowly; relatively large amount of fibrous connective tissue loosely built; intrusion pressure strangulating pulp; apical foramen enlarged and deeply resorbed
35	96	Regular	On molar, slight lateral resorption and apposition restoring root contour; on central incisor, pressure resorption of bone and apex of root
90	104	Special	Resorption without apposition on labial aspect of roots; inflammatory reaction in peridental membrane, but not in pulp
183	111	Regular	Bone compressed against cementum; resorption of both tissues; gingival peridental fibers inflamed and elongated
81	125	Regular	Alveolar process fractured between two central incisors
12	206	Regular	Right central incisor: hyperemic pulp and peridental membrane; very little resorption; left central: intense hyperemia in alveolar crest on labial aspect; no resorption
3	220	Special	Hypoplastic predentin matrix in developing permanent teeth; ameloblasts apparently not affected by type of deficient diet
4	220	Special	Great degree of radicular resorption; only slight evidence of apposition; no fracture; pulp stones in central incisor
379	41	Regular	Stretched apical fibers on lingual aspect; compressed on labial of right central incisor; resorption of bone and root on labial aspect of right central incisor and on left lateral incisor

food adequate in all respects. A comparison of decalcified sections of the mandible shows that in the control dog calcification of the permanent teeth has proceeded farther than in the dogs on a deficient diet. Molars and premolars, in the case of the control animal, show crowns fairly well formed; while, in the rachitic animal, only the bare outline can be observed.

In the dietary experiments with monkeys, the results were not so conclusive. In a few cases wherein the diet had been restricted in vitamin A over several

months, some delay in formation of the teeth was observed. The most outstanding feature was the difference in the degree of resorption and in the amount of new tissue subsequently formed in the resorbed areas.

A review of the experimental work thus far completed shows that maxillary permanent central incisors, cuspids and first molars have been moved, both by Angle appliances and by other appliances. Pressure, in some cases, was used which probably was slightly in excess of that employed in the clinic. With the exception of the first experiment, every effort was made to maintain this pressure within the limits of clinical practice. Photographs, roentgenograms, photomicrographs, motion pictures and experimental protocols have been presented as proof of the results described. Although the number of animals used was small, the results have been so concordant that one is justified in assuming that conditions in the laboratory closely paralleled those of the clinic. The fact that the resorption observed was of less extent than that seen clinically is due partly to the differences between patient and monkey. In the one case are generations of so-called civilization; in the other, the inexorable law of the survival of the fittest has produced an animal better prepared than the clinic patient to withstand the pressures of orthodontic bands.

Several examples taken from the experimental work will illustrate this point more clearly. When animals were placed on a special diet and extrusion-intrusion force was applied to maxillary central incisors, only soft tissue changes were demonstrated when the appliance had been in place twenty-four hours. (Figs. 1-2.) In another animal, after 111 days' treatment, the intrusion pressure compressed the bone directly against the cementum. (Fig. 3.) The gingival peridental membrane fibers were greatly inflamed and stretched. In a third animal, maintained for fifty days on a special diet, the intrusion pressure produced relatively deep apical resorption. (Fig. 4.) The extrusion pressures caused extensive changes in the peridental membrane and in the position of the bone trabeculae. The fibers were greatly stretched in the vicinity of the gingival portion of the root, and the direction of bone trabeculae followed the direction of bone. None of these animals suffered from any glandular dysfunction. Separation in the mesiodistal direction produced radicular resorption in those animals on special diets. In one case, the appliance was in place for 255 days, the equivalent of two years and ten months in a human being. The estimation of the age of monkeys is based upon a roentgenographic study of monkeys of known age in the laboratories of Carl Hartman, of Johns Hopkins University, Baltimore, Md. A report of this part of the research was published in January 1933.[2]

The first permanent molar in *Macacus rhesus* erupts through the bone when the animal is approximately 15 months old. Therefore, a 15-month-old monkey corresponds in dental development, as well as life cycle, to a 6-year-old child. The difference, therefore, between the two may be approximately represented by the ratio 5:1. Similarly, the incisors erupt at about 18 months and this corresponds to 7 years and 5 months in a child. This is in close agreement with the chronologic schedule. The cuspid at 2 years, 9 months (or 33 months) is comparable to that at 14 years in a child (or 168 months [33×5=165]), a figure well within the experimental error. (Fig. 5.)

Rotation of teeth, whether accomplished by hook and grass-line or by bracket band and arch wire, resulted in radicular resorption in the animals on

2. Marshall, J. A.: Internat. J. Orthodontia, 19:1-23 (Jan.) 1933.

special diets. There was only slight evidence of rebuilt tissue. When the crowns of molar teeth were tipped in a distal direction, there was some lateral resorption produced, the tissues being later rebuilt, and thus new tissue formed in the previously resorbed area.

A study of the chart, in which the experimental work has been summarized, indicates that, in all cases, the monkey in age was comparable to a child from 7 to 14 years. The growth cycles of the monkey are probably more closely correlated than in the child; and, from the available data, it would seem that the experimental orthodontic work was carried out at a time in the life cycle of the animal which was most favorable for the movement of the teeth and the resorption and redeposition of dental and osseous tissues. As has been stated before, the dietary régime adopted for the animals underwent some minor alterations, made necessary because certain animals accept dietary restrictions more easily than do others. One animal in particular objected to the food given him and refused to touch it at all. He seemed to prefer starvation to food without vitamin A. To save him from this hunger strike, it was necessary from time to time to break his schedule. Naturally, under such conditions, the dietary picture is much less conclusive than that obtained with rats in the early days of the vitamin experiments. In spite of these difficulties, a histopathologic report has been worked out which presents a few interesting facts. The chronologic table in resorption may be outlined somewhat as shown in the accompanying table.

Attempts constantly are being made to place the onus of responsibility for apical resorption on this type of appliance or another. If there is one thing which has been demonstrated in experimental work, it is this: Apical resorption may be produced in the laboratory by the use of either Angle appliances or other appliances. In view of these facts, do you not believe that the time has arrived for a detailed study of fundamentals involved in orthodontic practice; as a substitute for the continuous heckling over technic? It is admitted that fundamental principles are the basis of successful practice, but still the facts have not been accepted nor the fundamentals involved been agreed upon. If the various groups now so widely separated in the specialty of orthodontia would only get together and work in cooperation, orthodontia would make the greatest strides in the history of dentistry.

I remember in my boyhood hearing certain of the older men talking about the "amalgam war." How the charges and countercharges thundered across the battlefield of operative dentistry! They so continued until both sides saw the possibilities of conference, of discussion, of mutual appreciation and agreement. Similar battles have been waged in nearly every field of dentistry. It is true that scientific progress is advanced by discussion, but it is also true that progress is frustrated by a controversy over matters which lose their importance when compared with the basic fundamental principles involved. Is this not now the time for a frank, open discussion looking toward the settlement of disagreements by adoption of a tolerant, kindly, pacific feeling?

Whenever appliances are mentioned, either Baker anchorage, pin and tube, lingual bar, or hook and grass-line, there is usually a statement made to the effect that each individual appliance produces a force on living tissue very closely approaching the so-called physiologic optimum. There is scant evidence to justify this statement. Those who believe that tissue injury cannot be brought about in

the clinic need only to be reminded that the first animal used in the experiment experienced a fractured alveolar process as a result of pressure by a spring wire of a diameter usually employed in the clinic.

I suggest that the greatest advance in orthodontic practice will depend on the development of an accurate instrument to measure force, whether pressure, torque or tension. Present methods, as far as I am capable of judging, are inaccurate and inadequate. As I observe operators in the clinic, I note that one selects a bit of wire, gives it a twist, squints along its edge, and mutters to himself, "Guess that has torque enough for the case."

The metallurgic difficulties of the problem are as perplexing as the physiologic and anatomic ones. The various physical and physicochemical properties such as fatigue, annealing and crystallization are being studied with close attention, but there remain important questions to be solved: What changes occur in an alloy after repeated soldering operations? In what respect and to what degree is the tensile strength reduced by repeated heating, or how many times may a wire be bent or twisted before it breaks? I realize that these are, perhaps, rudimentary questions, propounded by one unskilled in orthodontic procedure, but since force moves teeth, we have yet to determine the pressure of the force and the length of time of its application, and whether treatment should be continuous or intermittent.

SUPERNUMERARY TEETH IN CYST: REPORT OF CASE

By ALBERT L. AXEL, D.D.S., Bradley Beach, N. J.

A BOY, aged 4 years, had all of the deciduous teeth except the upper left cuspid. Roentgenographic examination revealed a cystic sac enclosing a dense irregular mass, impacted in line with the twenty-four distinct teeth, varying in size from that of a millet seed to that of a grain of puffed rice. On close examination, these teeth were found to have a full enamel cap and dentin and open developing pulp chambers. According to their shapes, they were cuspids, incisors, bicuspids and molars (two). Recovery was uneventful.

Fig. 1.—Area before operation.

Fig. 2.—Area after operation.

Fig. 3.—Teeth in cyst.

missing deciduous cuspid. The area was anesthetized and a gum flap made, a parchment-like cystic sac being revealed. This was peelec out and, on opening, yielded

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Editorials

"PYORRHEA CANNOT BE CURED"

At recurring intervals, certain members of the profession give vent to the contention that "pyorrhea cannot be cured." Even when they lack the concrete courage to express these sentiments in so many words, their attitude, whenever they discuss the subject, or when they encounter patients in practice, would inevitably leave the inference that they are skeptical in the matter of curing the condition.

And the impression on the patient is bad. This subject has been discussed so frequently in the profession that there should be a better understanding than there is with reference to it. Again and again, the thinking men of the profession have called attention to the unfortunate impression that prevails regarding this disease. They have lamented the fact that the rank and file of the profession do not grapple with the problem as they should.

When the statement is made that "more teeth are lost from failure of the supporting structures of the teeth than from dental caries," and is, as is usually the case, permitted to go unchallenged, it would seem that the members of the profession would be roused to action and a more energetic campaign of prevention would be instituted than is manifest today. The apparent negligence of the profession on this one subject is almost a reflection on our calling.

As to the concrete statement concerning the possibility or impossibility of curing pyorrhea, a repetition of what has so frequently been said would seem to be in order. Of course, pyorrhea cannot be cured if the condition is neglected till the supporting structures become so impaired that the integrity of the supporting tissues is lost and the teeth are wobbling about like so many drunken men. Manifestly, it is then too late. But the nonchalant acceptance of defeat at the first attack of this disease is not in conformity with accepted dental practice. In fact, it is cowardly in the extreme. Even, in many cases, after the disease has made considerable progress, there is little excuse for assuming that it cannot be cured.

It is well within the mark to say that with the exception of some constitutional dyscrasia, pyorrhea is just as amenable to treatment as any of the ordinary diseases of the system. But it should be said that it cannot be cured by half measures. No disease demands more vigorous or intelligent management than this, and herein is possibly the reason that it has been so generally neglected. This whole subject needs a rededication.

When we consider the well-nigh spectacular results that sometimes attend the treatment of this disease, we must perforce exclaim at the pity that the condition should so generally be neglected. Teeth that have been loosened have frequently been rescued, and made firm and healthy by judicious treatment even when the flow of pus was only too apparent. There is no gainsaying that this can be done; it has been done in numberless cases. To change a mouth that has been crippled by loosening of the teeth, and by an unwholesome sanitary condition such as we see in pyorrhea, and have the teeth made firm and the gums healthy, is no mean achievement, and this is precisely what has been done and what is being done where dentists are doing their full duty.

No longer should we permit a wrong impression to be spread broadcast in connection with this disease. If a man engages to practice dentistry and tacitly announces his willingness or his desire to administer to the dental ills of the people, he should not shirk any of the responsibilities involved in his relations with the public, and when a patient applies to him for the treatment of any of the affections of the mouth, he has a very definite duty to perform. Either he must be prepared to treat the particular affection, or if, in the event of lack of ability or inclination, he does not wish to assume responsibility for treating the case, he must at once refer the case to some one who will conserve the patient's best interests by wholeheartedly instituting measures for adequate treatment. He must not shirk his obligations in any particular.

To say that pyorrhea cannot be cured or to infer that it cannot, and let it go at that, is neither good dentistry nor true ethics. Above all things, we must be honor bright with our patients and face facts as we find them.

PROPOSED NEW LEGISLATION

Through the Committee on Legislation of the American Dental Association, we learn that a new bill of interest to the dental profession has just been introduced in Congress. This bill, known as H. R. 3491, was introduced on January 22 by Representative Ross A. Collins of Mississippi, a former chairman of the important War Department Subcommittee on Appropriations and a man familiar with army needs.

The principal provisions of the bill are as follows: "A Brigadier General to head the Army Dental Corps, and an increase of Dental Officers to a Ratio of One for each Five Hundred enlisted strength of the Army."

The Committee on Legislation is to be congratulated on its activity in this matter, and further developments are awaited with interest.

THE ANTI-SYPHILIS CRUSADE

At a three-day conference of representative members of the various health agencies of the country, called by the Surgeon General of the United States Public Health Service, in the latter part of December last, there was launched a nation-wide crusade against the dread disease syphilis, as one of the most calamitous scourges upon the present-day social life of the nation. The announced purpose of the conference was to encourage discussion of the venereal disease problem in open forum.

Tuberculosis and syphilis, both a part of the price we have been compelled to pay for our advanced state of civilization, are the two scourges upon humanity which have exacted the severest toll upon community life, and the two that have given the medical profession the greatest concern in its effort to subdue disease in the human being. Much progress has been made in recent years toward the control of both these almost intractable diseases, but we are still far from an entirely satisfactory solution of the two problems. The very nature of syphilis and the unfortunate belief of many of its victims that syphilis is always considered the wage of immorality are added handicaps upon any and all efforts toward its consideration on the same basis as other diseases—bringing its discussion into the open forum, as it were.

The social stigma which this dread disease, in the minds of the laity, stamps upon its unfortunate victim makes him an easy prey for the quacks and nostrum venders who thrive and have their being in a credulity born of false pride.

This nation-wide effort can do much toward disseminating knowledge of the serious consequences of such false pride, which can and does leave in its trail suffering, travail and death even unto the fourth generation. Dentistry can, by virtue of the intimacy of its ministrations to the public, play an important part in exposing this hydra-headed monster of disease to the searching light of publicity.

The lesions of syphilis, in both its primary and secondary stages, manifest themselves in the oral cavity more frequently than in any other exposed area, and through the ability of the dentist to recognize these early manifestations, he can do much toward directing

the patient to an avenue of relief. Syphilis, like most diseases, is more readily amenable to treatment in its earliest stages, and the dental practitioner is in position in many cases to discover the presence of the disease in its earliest and most tractable stages.

This is but another responsibility upon the dentist as the result of the increasing importance of closer cooperation between the dentist and the physician, and one that the dentist should willingly, if not eagerly, accept as a part of his professional health obligation to his clientele; and, too, another aspect of dental practice in which dentistry can further demonstrate its importance and helpfulness as a public health service.

The dental practitioner very definitely has a three-fold interest in this important movement to control one of the most serious diseases that prey upon the very soul of the moral and social fabric of the nation: first, his moral and professional obligation to his clientele as a directing and helpful guide to the proper source of relief; second, his obligation to himself and those dependent upon him, to avoid becoming infected himself through ignorance or carelessness; third, his moral and professional obligation to avoid transference of this serious malady from one patient to another.

There have been recorded many instances of infection with syphilis in dental operators who have unknowingly or carelessly been exposed in performing dental operations in the mouths of those afflicted with syphilis. And in this connection, and appropriate to the discussion of this self aspect of the problem, some one has quite pertinently said that exposure to syphilis is one of the necessary risks of the dental profession. There have also been recorded instances in which the dental operator has transferred this infection to other patients through carelessness in sterilization procedures, and in such cases the dentist has been held legally liable for the damage caused.

While one aspect of the question under consideration may be considered somewhat of a selfish one, however, selfishly or otherwise, let us lend our aid as a health-service profession to the effort to stamp out a most prevalent and serious disease that leaves a train of evils upon the generations to follow.

L. P. A.

Obituary

WILLIAM D. TRACY, D.D.S.
(1873-1937)

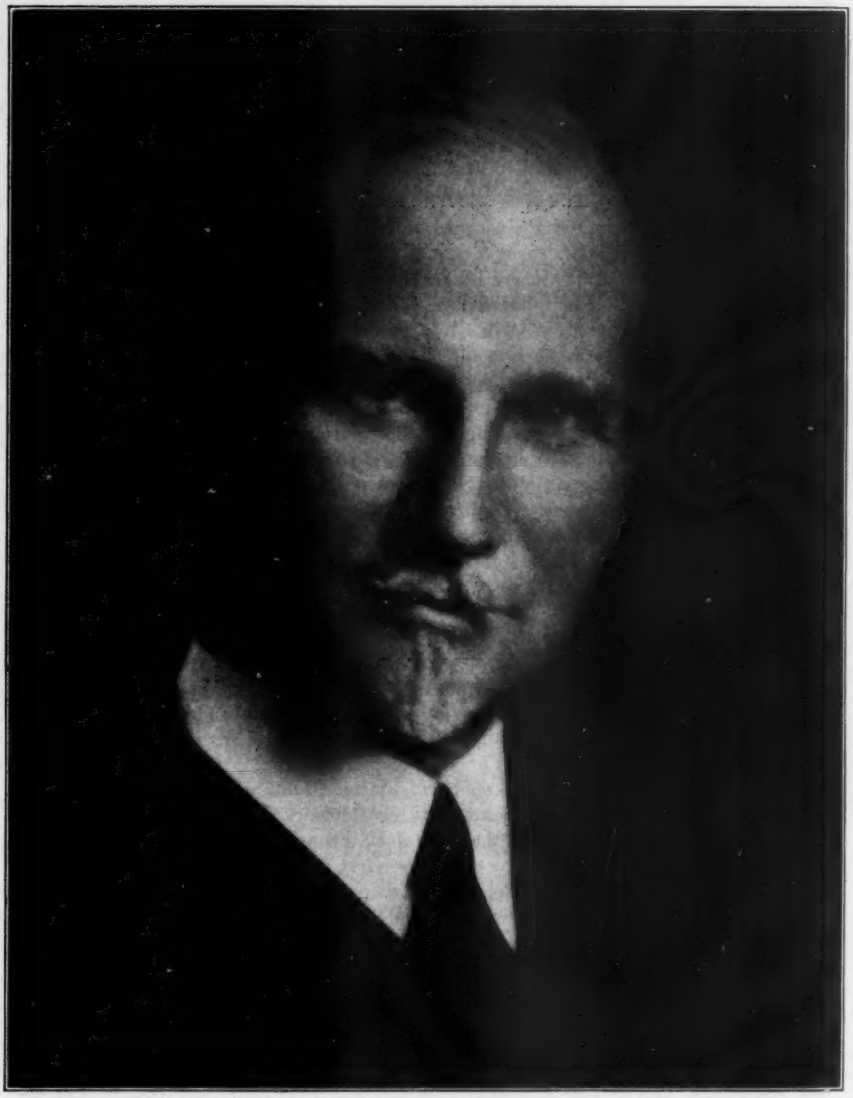
Dr. William Dwight Tracy was born of New England parents, in Ridgewood, N. J., August 16, 1873. His early education was obtained in the grammar and high schools of Worcester, Mass., where his parents lived in his early boyhood. In 1893, he entered the University of Pennsylvania Dental School, from which institution he received his D.D.S. degree in 1896. Immediately after his graduation he became associated in practice with the late Dr. Safford G. Perry, in New York City, an association which continued until 1904, when he established himself in practice with his cousin, Dr. M. C. Tracy, in New York City.

Dr. Tracy was, from the beginning of his professional career, intensely interested in the organized efforts to promote dentistry, and took a most active part in the political and educational phases of dentistry as expressed through dental society activities. A slight suggestion of the scope of his professional and socio-professional activities may be gained from a partial enumeration of the various organizations with which he was connected. He was a member of the American Dental Association; a member of the Dental Society of the State of New York; a member and Past-President of the First District Dental Society of the State of New York; a member of the New York Academy of Dentistry; the American Academy of Restorative Dentistry; the American Society for the Promotion of Dentistry for Children; the American Association for the Advancement of Science; the New York Academy of Medicine; member and ex-President of the New York Odontological Society; a member of the Delta Sigma Delta dental fraternity; a Fellow of the American College of Dentists, and a member of the honorary dental fraternity, Omicron Kappa Upsilon.

He was professor of operative dentistry of the Columbia University School of Dentistry from 1929 to 1932; a member of the Advisory Committee of the Guggenheim Dental Clinic; chairman of the Dental Hygiene Committee, New York State Health Commission; member of the Oral Hygiene Committee of Greater New York; a trustee of the University of Pennsylvania since 1932; member of the Board of Directors of the New York Tuberculosis and Health Association, and a member of the Dental Advisory Committee of the New York City Board of Health.

Among the honors which Dr. Tracy received from the dental profession were: the office of Supreme Grand Master of the Delta Sigma Delta dental fraternity; the Newell Sill Jenkins Medal from the Connecticut State Dental Society, and honorary membership in dental societies of South America and Europe. He was awarded the William Jarvie Medal of the Dental Society of the State of New York for outstanding and conspicuous service to dentistry, which was to be conferred upon him at the 1937 meeting of the State Society.

Dr. Tracy's death came as a distinct shock to the dental profession of America.



WILLIAM DWIGHT TRACY, D.D.S.
(1873-1937)

It was known to a number of his closest friends that he had suffered, a few days before, a severe heart attack, but it was hopefully expected that he would survive the shock without fatality. The news of his death has cast a pall of sadness over the entire profession.

It is indeed difficult for one who so fully observed and appreciated the admirable characteristics of William D. Tracy to portray in anything like adequate terms the influence that his life exerted upon the dental profession. One of the more admirable traits of "Billy" Tracy, as he was affectionately known by his closest friends, was an inherent heart quality—a quality of character which was summed up in his conception of that which was to him noblest and best in the lives of those nearest to him. He was a lover and devotee of art, music, painting and sculpture. His very nature thrilled in response to all that appealed to the higher things of life, and he was ever the embodiment of that type of culture which finds its greatest pleasure in the contemplation of the ideally beautiful. His spirit of helpfulness was perennial—born of his love for his fellowman and expressed in a quiet and unostentatious manner, as befitting the nobility of character that is the outstanding trait of the high type of gentleman that he was.

Dr. Tracy was not a prolific writer, but the influence upon the profession which he unconsciously exerted emanated from the dignity and respect with which he treated his professional work, thus stimulating the same wholesome professional attitude in all his colleagues who enjoyed the privilege of his friendship and acquaintance. He lived his life in such a way as to make his influence upon others his chief benefaction to dentistry.

At a time in the development of dentistry when we are endeavoring to promote the educational cultural aspects of our profession, the loss of such an outstanding influence in that particular direction is truly a calamity. "Billy" Tracy was in all a most lovable character and one who was ever spreading the beneficent influence of the highest type of cultural professional gentleman.

Dr. Tracy's death occurred on Thursday, February 11, at his late residence, 1170 Fifth Ave., New York City, in his sixty-fourth year. He is survived by his widow and three sons: Dwight Preston Tracy, Lawrence Edward Tracy and William Ward Tracy, a practicing dentist in New York.

L. P. A.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Preventing Adhesion of Guttapercha—To prevent the adhesion of guttapercha or cement to instruments, dip the point in talcum powder.—*C. C. Norris, Oshkosh, Wis.*

Removing Clasps from Cast—To hold wire clasps together when removing them from a cast, a piece of heavy paper is slipped between clasps and model, and sticky wax is allowed to flow over the clasps, sticking them to the paper. This will serve as a splint and, after investing, the paper will burn off when heat is applied.—*Edward T. Evans, Decatur, Ill.*

Blowpipe in Waxing—Have you forgotten the original office of that efficient appliance, the Tench mouth blowpipe, in general use today in modern impression taking? Slightly enlarge the air outlet hole, slightly spread out the end of the wick, and you will get a small brush flame particularly useful in waxing a set of teeth.—*W. H. Savage, Clifton Forge, Va.*

Removing Tin from Dentures—To make the removal of tin from dentures easy and thorough, a soft amalgam of tin and mercury is rubbed over the tin lining, being left for thirty minutes. The tin can then be removed very quickly. Mercury squeezed from alloy fillings and tin stripped from the body of plate will cost nothing. —*Gilbert F. Laue, Gary, Ind.*

To Reline Vulcanite Plates—Luxene repair material is ideal owing to the fact that it is cured at a very low temperature, with no color change or brittleness of the plate. Its easy flowing quality prevents thickening of the plate. It is also excellent for making repairs. It can also be used in repairing plates made of the ordinary pink bases with good results.—*Gilbert F. Laue, Gary, Ind.*

A Few Extraction "Don'ts"—Don't (1) extract a tooth without a roentgenogram; (2) extract an acutely infected tooth; (3) extract a tooth in an unhygienic mouth; (4) extract with nitrous oxide without an assistant; (5) extract with nitrous oxide without having all your instruments ready on the tray, regular and emergency; (6) extract with nitrous oxide, with outsiders in the operating room; (7) extract with nitrous oxide without strapping the patient to the chair; (8) extract a tooth on a child's first visit; try to put it off until the second visit.—*J. Leo Epstein, 481 73rd St., Brooklyn, N. Y.*

Ideals—A short word with a tremendous meaning, ideals are oftener sought than gratified. Gratification results from trying, as well as achievement, and nothing short of an ideal should be aspired to. Ideals are standardized goals, often too high to reach, but not too high to try for. Ideals are inspirational when they prompt technical improvement in dental procedures. Ideals are found in both material things and in persons. Often a dentist has an ideal and successful technic which others might desire. An attitude of jealousy and prejudice in such cases should be supplanted by a friendly cooperation which would be more apt to result in the impartation of such an ideal to you. Ideals are stabilizers which steady the dentist who is susceptible to their influences.—*Herbert Ely Williams, Red Bank, N. J.*

Periodontal Lesions Versus Decay—One of Herbert Ely Williams' articles in this column in THE JOURNAL prompts me to say that a greater percentage of teeth are lost from periodontal disease than from decay; disharmony of occlusion plus lack of use being the main cause. Preventive dentistry in operative procedure is quite successful and is diminishing loss by decay. Many good operators are failing to maintain the trust of their patients by neglecting the periodontal aspect. The welfare of dentistry and those who put their trust in us demand that we must assure, to the best of our ability, the distribution of stress over the greatest possible supporting area, not neglecting thorough scaling and stimulation. This largely is a means of saving the teeth of young people through to old age. This will also prevent 50 per cent of decay. How many of our dental school requirements are as thorough and rigid in periodontia as in operative technic?—*A. Moorman Hardaway, Heyburn Bldg., Louisville, Ky.*

Cocoa Butter and Silicate Cements—When a good silicate material has been properly manipulated, the use of cocoa butter or any other lubricant is not only unnecessary to avoid adhesion of the celluloid strip or matrix to the filling, but also forces grease into the plastic substance damaging all its good physical properties. If the powder and liquid have been mixed according to the manufacturer's directions and held in the cavity under slight pressure with a clean celluloid strip for the prescribed time (usually three minutes), the filling will be sufficiently hardened that the strip will automatically spring away from the filling when tension is released. Then is the time to place cocoa butter over the filling surface. Modified cocoa butter furnished in collapsible tubes and having proper consistency the year round is safer to use than pure cocoa butter in sticks or cakes, which is susceptible to modification by heat. This coating of cocoa butter is left on the surface about ten or fifteen minutes, during which time the material acquires approximately one-half its ultimate hardness. It is important that this step of the technic be followed as directed. The operator must not omit the cocoa butter or use volatile varnishes at this time. After ten or more minutes, the cocoa butter is wiped away with dry cotton (no solvents are used) and any excess filling material that interferes with articulation is carefully removed by lubricated abrasives (stones and disks, not metal cutting instruments). The filling and surrounding tooth surface is then coated with a good cavity varnish made for that purpose. The patient is informed as to the dentist's purpose in order to gain his cooperation in protecting the restoration for at least twenty-four or thirty-six hours before the final finishing.—*Robert L. Foster, 5703 E. Washington St., Indianapolis, Ind.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

Potassium Permanganate-Squibb.—A brand of potassium permanganate, U.S.P.*

Manufactured by E. R. Squibb & Sons, New York City. No U. S. patents or trademarks.

Potassium Permanganate Tablets, 1 grain.
Potassium Permanganate Tablets, 5 grains.

BARBITAL AND BARBITAL COMPOUNDS†

Barbital-Squibb.—A brand of barbital, U.S.P.

Manufactured by E. R. Squibb & Sons, New York City. No U. S. patents or trademarks.

Tablets Barbital-Squibb, 5 grains.

Phenobarbital-Squibb.—A brand of phenobarbital, U.S.P.

Manufactured by E. R. Squibb & Sons, New York City. No U. S. patents or trademarks.

Tablets Phenobarbital ¼ grain (0.015 gm.)-Squibb
Tablets Phenobarbital ½ grain (0.03 gm.)-Squibb
Tablets Phenobarbital 1½ grains (0.09 gm.)-Squibb

The following dosage form of Veronal (A.D.R. 1935, p. 60) has been accepted:

Elixir of Veronal: Each fluidrachm contains veronal 2 grains, in a menstruum containing alcohol 33.5 per cent.

Manufactured by Winthrop Chemical Co., Inc., New York City.

The following dosage form of Luminal (A.D.R. 1935, p. 61) has been accepted:

Elixir of Luminal: Each 4 c.c. (1 fluidrachm) contains 0.0162 gm. (¼ grain) in a menstruum containing alcohol 26 per cent.

Manufactured by Winthrop Chemical Co., Inc., New York City.

Neonal.—n-Butylethylbarbituric acid.—n-Butylethylmalonylurea.—2, 4, 6-trioxy-5-n-Butylethylpyrimidin—(C_4H_9) (C_2H_5) C. CONH. CONH. CO.—Neonal differs from barbital, U.S.P. (diethylbarbituric acid) in that one of the ethyl groups of the former is replaced by a normal butyl group.

ACTIONS AND USES: The actions and uses of neonal are essentially similar to those of barbital, but it is about three times as active as the latter; hence, it is used in correspondingly smaller doses.

DOSAGE: From 0.05 to 0.4 gm. (¾ to 6 grains). For mild insomnia, 0.05 to 0.1 gm. (¾ to 1½ grains) is said ordinarily to produce sleep. A dose of 0.4 gm. (6 grains) is the maximum dose which should be required in the course of twenty-four hours, administered in divided doses.

Manufactured by the Abbott Laboratories, North Chicago, Ill., under U. S. patent 1,609,520 (Dec. 7, 1926; expires 1932) by license of Les Etablissements Poulenc Frères, Paris. U. S. trademark 175,580.

Neonal Tablets, 0.1 gm.

(For further tests of identity and purity, see N.N.R., 1936, p. 105.)

*Accepted Dental Remedies, 1935, p. 159.

†Accepted Dental Remedies, 1935, p. 57.

TOOTH POWDER—A.D.R.

The Council has authorized publication of the following statement.

SAMUEL M. GORDON, *Secretary.*

From time to time, inquiries have been received from individual dentists and from dental societies concerning a recipe for the manufacture of a tooth powder. National Formulary VI carries a formula for a dentifrice that may be considered to fulfil all the legitimate requirements of a dentifrice; namely, to aid the toothbrush in cleaning the surfaces of the teeth. Furthermore, this dentifrice is nonmedicated. The formula and the method of preparation follow.

Hard soap, in fine powder	50 gm.
Precipitated calcium carbonate	935 gm.
Soluble saccharin	2 gm.
Oil of peppermint	4 c.c.
Oil of cinnamon	2 c.c.
Methyl salicylate	8 c.c.
To make about	1,000 gm.

Thoroughly triturate the soluble saccharin, the oils and the methyl salicylate with about one-half of the precipitated calcium carbonate, and mix the soap with the remainder of the precipitated calcium carbonate. Mix the two powders thoroughly, and pass through a fine sieve. Keep the dentifrice in well-closed containers.

This, it will be noted, is essentially the formula that has come to be known as the Philadelphia Dental Dispensary Tooth Powder.[1]

Concerning the acceptability of a product of this type for A.D.R., it has been decided that such a product may be acceptable for admission to A.D.R. provided: 1. It shall be labeled Dentifrice-A.D.R. (Brand), Tooth Powder-A.D.R. (Brand), So-and-So's Dentifrice-A.D.R., So-and-So's Tooth Powder-A.D.R. or So-and-So's Dentifrice or Tooth Powder, Compounded in Accordance with the Specifications in Accepted Dental Remedies. (The description N. F. Dentifrice is not meaningful enough for the Council's purpose, since the Council requests information not only regarding the chemical properties, but also regarding the physical properties of the dentifrice.) 2. The precipitated calcium carbonate used in the preparation of the dentifrice is an acceptable brand. 3. Information on the abrasiveness of the finished product is submitted. 4. Evidence is submitted of adherence of the finished product to the published formula. 5. Acceptable advertising is submitted, if any is issued.

NOVOTHESIA-DICKS'—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Novothesia, put out by F. A. Dicks & Co., Inc., New Orleans, or the Specialty Products Co., of the same address, as "an antiseptic anesthesia" for medicine and surgery, was examined in the A.D.A. Bureau of Chemistry in 1933 and in 1935. As will be seen below, the results of the two examinations are essentially similar.

Novothesia is stated to be "a powerful antiseptic solution pleasantly flavored, containing

1. Prinz, Hermann: Dental Formulary, Philadelphia: Lea & Febiger, 1930, p. 161.

a non-toxic local anesthesia [sic], producing numbness when placed upon mucous surfaces." It is stated to be "Powerfully germicidal." It is recommended by the promoters for a wide variety of purposes in dentistry, such as allaying pain due to pulpitis, hypersensitiveness of dentin, pyorrhea alveolaris, desensitizing before puncturing with the needle, abscesses and scaling, and to eliminate gagging during plaster impression taking and after extractions. The suggested uses in surgery are: in paracentesis of the ear drum, incision of the ear drum, otitis media, earache of otitis externa, peritonsillar abscess, nasal anesthesia and streptococcic infection, and for rectal work, to be applied as judgment directs. Regarding its use in chiropody, a number of testimonials are presented. It has not been presented to the Council, either by the F. A. Dicks & Co., Inc., or by the Specialty Products Company. A 2-ounce bottle sells for $3.

According to information received from a dentist, Novothesia is stated to have the following composition:

Extract of Mullein	30.60%
Alcohol	58.75%
Ethyl Amino Benzoate	6.44%
Thymol	.11%
Boric Acid	.85%
Benzoic Acid	.16%
Oil Peppermint	1.20%
Oil White Thyme	.02%
Oil Eucalphtol [sic]	.06%
H_2O	1.81%

It is unlikely that this statement of composition represents the result of analytic determinations. It apparently is calculated from the amount of each ingredient used in mixing the preparation.

A statement of composition does not appear on the label. The presence of alcohol is declared, but this is required by the Federal Food and Drugs Act.

The use of extract of mullein in a product designed for the induction of anesthesia by a topical application is not based on knowledge which is readily available. Mullein is so little regarded by modern pharmacologists that only a few words are devoted to a description of it in acceptable texts. Years ago, it was used internally as a demulcent, but the rationality of its use in this connection is not apparent. It represents an unnecessary loading of the formula.

Examination carried out in the A.D.A. Bureau of Chemistry revealed the presence of ethyl aminobenzoate, a plant material, alcohol, borates (probably in the form of boric acid) and essential oils, with an odor of peppermint predominating.

The accompanying table gives the results of the 1933 and 1935 investigations. No other tests were made.

	1933	1935
Specific gravity	0.917	0.919
Refractive index	.....	1.3771
Total solids 100 C.	6.6 gm./100 c.c.*	7.3 gm./100 c.c.
Ash	0.4 gm./100 c.c.	....
Benzocaine	5.5 gm./100 c.c.	5.6 gm./100 c.c.
Boric acid	0.86 gm./100 c.c.	Found
Alcohol	55.5% by volume	Found

*Odor of peppermint.

From the foregoing, it may be concluded that Novothesia represents a solution of ethyl aminobenzoate in a medium of alcohol and water flavored by the addition of essential oils.

No evidence has been made available to the Council that ethyl aminobenzoate, as compounded in Novothesia, is more useful than a solution of ethyl aminobenzoate in alcohol as described in Accepted Dental Remedies, or a simple ointment of ethyl aminobenzoate. The following, from a comparative study of topical anesthetics,[1] bears reiteration in this connection:

> Another point worth reiterating is that appreciable depths of anesthesia were obtained, or were thought to have been obtained, with solutions as bland and as inert as normal saline solution. When such apparently positive results can be obtained in a "blind test," when there are no suggestive factors such as fancy bottles, impressive labels proclaiming phenomenal results and high prices for the articles in question, it is plain that, under ordinary clinical conditions, when suggestive elements are allowed full play, a solution of almost anything can be expected to possess some apparent activity. Therefore, the true value of a topical anesthetic for use on the mucous membranes of the mouth appears to be very limited.

The name "Novothesia" is therapeutically suggestive. The composition is unduly complex. No evidence has been made available that Novothesia is a powerful antiseptic solution when used on the mucous surfaces of the mouth.

If topical anesthesia is felt desirable preoperatively, the judicious use of dilute cocaine solutions or of ethyl aminobenzoate, 10 per cent in alcohol, fulfils every legitimate requirement. These can be obtained inexpensively as against the grossly exaggerated cost of $3 for 2 ounces of a 6 per cent solution of benzocaine sold under this fanciful name.

Novothesia is declared inadmissible to A.D.R. because a statement of composition does not appear on the label (Rule 1); it is advertised with unwarranted therapeutic claims (Rule 6); it is a solution of well known materials marketed under a therapeutically suggestive name (Rule 8), and it represents an unnecessarily complex mixture for obtaining local anesthesia by absorption through the intact mucous membrane (Rule 10).

NEO DENT-COAGULANT UNIT—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Neo Dent-Coagulant Unit is advertised to dentists through the mails and in certain dental journals as follows:

> NOW—You have a true dentine coagulant that sterilizes and desensitizes without discoloration with
>
> NEO DENT-COAGULANT UNIT
>
> Another new and original achievement of Dr. E. P. Brady of the Washington University of St. Louis, who is also the originator of Neo-Balsam Compound, Neo-Capper, Neo-Siltrate and other meritorious dental treatments.
>
> What Neo Dent-Coagulant is
>
> (1) Neo Dent-Coagulant Unit is composed of a bottle of Neo Dent-Coagulant and a bottle of Neo-Colac. The Neo Dent-Coagulant chemically coagulates or sears both the organic and inorganic substance of the dentine, destroying all micro organisms. The Neo-Colac supplements Neo Dent-Coagulant and combines with it so that the area involved becomes impervious—nothing can penetrate the treated area—not even arsenic or methylene-blue.

1. Tainter, M. L., and Moose, S. B.: Studies in Topical Anesthesia. I. Efficiency of Certain Common Anesthetics When Used on Gums, J.A.D.A., 23:244 (Feb.) 1936.

What the Unit Accomplishes

(2) The coagulation formed is a true dentine coagulant and immediately and indefinitely sterilizes and desensitizes. It prevents capillarity and recurrent decay. It closely resembles secondary dentine found in those translucent zones of arrested decay produced by nature. The block is so complete that bacterial invasion through leaky filling and chemical irritants from silicate and other cements cannot penetrate it. It is also a block against thermal changes. It indefinitely desensitizes all forms of sensitive dentine. It does all this without discoloration.

Where It Is Indicated

(3) It is indicated as a block in all exposed dentine whether in teeth prepared for silicate or metallic fillings or for inlays, gold or jacket crowns in which it protects the pulp against chemical and bacterial invasions as well as thermal changes. It also indefinitely desensitizes all forms of sensitive dentine such as those sensitive gingival margin areas, exposed pyorrhetic roots, acid eroded teeth and sensitive cavities. It is effective immediately and indefinitely.—D. Survey, 12:61 (Sept.) 1936.

Essentially similar claims are made in mail advertising. Attempts to secure from the A. A. Brown Dental Mfg. Co. a quantitative statement of composition of the Neo Dent-Coagulant No. 4 and Neo Colac No. 5, which go to make up the Neo Dent-Coagulant Unit, were fruitless, although the firm was supplied with a copy of the rules of the Council and the form for the submission of articles.

A review of the available literature reveals several articles by E. P. Brady, D.D.S., in which drugs related to these products might be mentioned. In an article, "Dental Caries as Related to Pedodontia"[2] are some remarks that might apply to the consideration of these products. After describing the use of liquid phenol as a coagulant, Dr. Brady describes experiments with a 5 per cent solution of trichloroacetic acid in alcohol as a coagulant in these words:

In another series of experiments a 5 per cent solution of trichloracetic acid in alcohol was used as the coagulant. Upon the evaporation of the alcohol this leaves a thin layer of concentrated trichloracetic acid upon the surface of the cavity. After about a minute and a half the excess is removed and then the cavity dried. This seems not only to coagulate the tissue but also to aid in the penetration of the varnishes. After several years of this procedure, particularly when used in slice preparations, I am of the opinion that a decided benefit is gained by such treatment. . . . The purpose and ultimate aim, according to my ideas, would be to block the tubuli and create a condition similar to a condition that we find present in teeth having tubular calcification or zones of translucency.

In another article, under the title "The Carious Tooth,"[3] after discussing the use of carbolic acid, paraform, or solid formaldehyde, ammoniacal silver nitrate, zinc chloride and the so-called Robinson's remedy, he writes:

I wish at this point to recommend a simple technique that has given me very good results. Whenever the dentin is injured, dry it and apply a solution of trichloracetic acid in ethyl acetate, say about fifty grains of the acid to one ounce of ethyl acetate. A modification of this formula may be used by taking a few crystals of trichloracetic acid and placing them in a dappen dish and moistening with alcohol, a few drops being all that is necessary.

After considering that the cavity has been disinfected by the foregoing treatment, and Tomes' fibers coagulated with the acid, and the excess removed, the operator adopts the following procedure:

The cavity is now dried and painted with a weak varnish solution, containing twenty grains of gum copal dissolved in acetone. The acetone is used because it is a good solvent and is also compatible with both oils and water.

This procedure, Dr. Brady believes,

. . . answers of the qualifications that are necessary to convert a tooth which has not sufficient resistance into one in which the resistance is raised sufficiently to overcome the inroads of decay.

2. Brady, E. P.: Internat. J. Orthodontia, 19:632-633, (June) 1933.
3. Brady, E. P.: D. Cosmos, 76:1058 (Oct.) 1934.

Thus, it is noted that Dr. Brady uses essentially a 10 per cent solution of trichloroacetic acid in ethyl acetate or a solution of trichloroacetic acid in alcohol of unknown concentration and an acetone solution of gum copal varnish of unknown concentration. Mention is made of the use of other drugs in these articles, but these have no bearing on the subject.

Readers of the advertisement quoted in the beginning of this report may rightfully assume that Neo Dent-Coagulant Unit contains drugs that were not available or used in dentistry up to the time that Neo Dent-Coagulant Unit was offered to the public, or that some new property of an old drug was found; for it is referred to as "another new and original achievement of Dr. E. P. Brady of the Washington University of St. Louis . . ." although no such claim was made in the original article by Dr. Brady.

Because of inquiries received, and the fruitless attempt to secure a frank statement of composition, examination was undertaken in the A.D.A. Bureau of Chemistry. The Chemist's report, which follows, shows that each of the Neo Dent-Coagulant Units sells for $2 and each unit consists of two bottles labeled No. 4 Neo Dent-Coagulant and No. 5 Neo Colac. No. 4 Neo Dent-Coagulant was found, on examination, to be essentially a 10 per cent solution of trichloroacetic acid in ethyl acetate. No. 5 Neo Colac could be simulated by mixing together 19 c.c. of an acetone solution of the soluble portion of gum copal (containing in each hundred cubic centimeters, 13.3 gm. of the resin) and 1.7 c.c. of amyl acetate diluted with acetone to make 25 c.c. The examination of No. 4 Neo Dent-Coagulant yields the same results as those which may be calculated from one of the articles mentioned, but different results from those of the other.

The use of trichloroacetic acid and of gum copal in dentistry is not new. The acid has been used on the soft tissues largely as a caustic, and on the hard tissues in treatment of hypersensitive dentin. Its uses as a protein coagulant are well known, and, on this account, it is widely used in blood chemistry tests for precipitation of proteins; and this may also account for its use on dentin.

The only evidence in support of the claims made in advertising the products are those of Brady mentioned above. Nowhere does carefully controlled clinical evidence from independent sources appear to warrant the far-reaching claims made in advertising the product. In any event, both trichloroacetic acid and gum copal are readily available substances which should not be sold to the dentist under a noninforming proprietary name.

In view of the foregoing, Neo Dent-Coagulant Unit is declared not admissible to A.D.R. The chemist's report follows:

Ten original packages of Neo Dent-Coagulant Unit (A. A. Brown Dental Mfg. Co., St. Louis, Mo.) price $2 each, were purchased on the open market for examination.

Each unit consisted of two bottles labeled: "No. 4 Neo Dent-Coagulant" and "No. 5 Neo-Colac." A statement of composition does not appear on the label.

NEO DENT-COAGULANT

Each package of Neo Dent-Coagulant contained 17 c.c. (about one-half ounce) of a clear, light colorless liquid possessing an odor of ethyl acetate. It reacted acid to methyl orange.

The specific gravity of one lot was 0.93 and of another, 0.95. The refractive index of one lot was 1.3772 and of another, 1.3820.

Ethyl acetate was identified by odor, boiling point and specific gravity.

Trichloroacetic acid was identified by a green flame test, by the acid reaction of the residual liquid after evaporation of most of the ethyl acetate and by the preparation of a compound with benzylamine.[4] This melted at 118-119 C. and had a neutralization equiva-

4. Buehler, C. A.; Carson, Louise, and Edds, Rachel: J. Am. Chem. Soc., 57:2181 (Nov.) 1935.

lent of 262. When mixed with a compound prepared similarly, from an authentic specimen of trichloroacetic acid, the mixture melted at 120 C.

Phenolic compounds were not found.

Quantitative determinations yielded:

	1st lot	2nd lot
Trichloroacetic acid	9.8 gm./100 c.c.	10.8 gm./100 c.c.
Ethyl acetate (by distillation)	90 per cent by volume	

On the basis of the foregoing, a solution of trichloroacetic acid, 5 gm. in ethyl acetate to make 50 c.c., was prepared. The specific gravity was 0.94 and the refractive index 1.3800. It is therefore concluded that Neo Dent-Coagulant is essentially a 10 per cent solution of trichloroacetic acid in ethyl acetate.

Neo Colac No. 5.—The following appeared on the label:

Neo Colac
To Intensify Neo Dent Coagulant
Formula of Dr. E. P. Brady

Each package contained 17 c.c. (approximately one-half ounce) of a light straw-colored liquid, with suspended particles. The odor was suggestive of acetone and amyl acetate. On evaporation of the liquid, a slightly brownish film remained.

Neo Colac had a specific gravity of 0.816 (at 24 C.) and a refractive index of 1.3792 (at 23 C.).

The residue, dried at 100 C., was 10.1 gm. per hundred cubic centimeters. It was a light straw-colored resinous substance suggestive of the soluble part of gum copal.[5]

Distillation yielded two main portions:

55— 80 C.	75 per cent by volume
130—150 C.	6.5 per cent by volume

The first fractions were bulked and redistilled. The distillate had a boiling point of 54-58 C., and an odor of acetone, and formed dibenzylideneacetone. The melting point, 110-111 C., was not depressed when the distillate was mixed with a specimen prepared from an authentic specimen of acetone.

The second fraction (1.3 c.c.) was redistilled from a microdistilling flask. It boiled at 130-135 C. and possessed an odor of amyl acetate. It had a specific gravity of 0.85, a refractive index of 1.4010 (23 C.) and a molecular weight of 137 (by saponification). These constants agree favorably with the recorded data for isoamyl acetate.

From the foregoing, it was tentatively concluded that Neo Colac was essentially a solution of the acetone soluble portion of gum copal (approximately 10 per cent weight by volume) acetone and amyl acetate.

On this basis, the following was undertaken:

Twenty-five grams of finely powdered gum copal (purchased on the open market as such) was mixed with an equal weight of white sand, placed in a Soxhlet extractor and extracted with acetone. The solution was transferred to a 100-c.c. graduate, and acetone added to the 100-c.c. mark. Two grams of powdered talcum was added, shaken and filtered. This yielded a solution containing 13.3 gm. per hundred cubic centimeters.

Nineteen cubic centimeters of the foregoing solution, 1.7 c.c. amyl acetate, was diluted with acetone to make 25 c.c. The odor compared favorably with that of Neo Colac. The specific gravity was 0.82 and the refractive index was 1.3790. From the foregoing, it is concluded that a liquid prepared as described would have the essential properties of Neo Colac.

5. Gum Copal Solution for Cavity Lining and Varnish, J.A.D.A., 23:2374 (Dec.) 1936.

As this report was about to go to press, the two following communications were received from Dr. Brady. They are published with his permission.

To the Council on Dental Therapeutics:

I understand that you are inquiring as to my relations with A. A. Brown Dental Mfg. Co., St. Louis. I will say that I am neither directly nor indirectly connected with this concern.

I have on all occasions given my formulas to the profession and then this firm has at the suggestion of the profession in St. Louis placed same on the market.

As far as I am concerned it will be very agreeable to me if you can curtail or suppress the commercialization of these products.

Inclosed find a letter of recent date, written to the above concern, just what the reaction will be I am unable to say.

(Signed) E. P. BRADY.

To the A. A. Brown Dental Mfg. Co., St. Louis, Mo.

This is to formally notify you to remove my name from your literature, labels, advertising and in any way to call attention to my name as associated with your manufactured products.

I would greatly appreciate it if you would cease the manufacture of such goods as have borne my name in the past. You would relieve me of much embarrassment by so doing and, in the time which it might take to comply with this request, the very least you might do, would be to comply with the regulations of the Therapeutic Council of the American Dental Association.

I hope I will not have to again call your attention to the above demands.

(Signed) E. P. BRADY.

The position as expressed by Dr. Brady in these letters is highly commendable. It is a further sign of the growing appreciation of the desirability of marketing dental products in accord with the conditions laid down by the Council on Dental Therapeutics.

OCCY-CRYSTINE—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Occy-Crystine is advertised to the dental profession by Occy-Crystine, New York City.

The label states that it is "a standardized hypertonic solution of sodium, magnesium, potassium and calcium salts." Elsewhere in advertising, mention of calcium is omitted. An 8-ounce bottle was purchased for $1.23.

Much is made of the precipitation of sulfur and the consequent benefits to be derived therefrom in a wide range of indefinite conditions in dentistry and in general medicine. To dentists, it is an eliminant for preoperative and postoperative treatment; for the quick clotting of blood (to be taken for a week or two in advance of operation); for pyorrhea, stomatitis, Vincent's disease and gum recession; for remineralizing the blood and lessening calcium losses and to reactivate the salivary glands, thus making direct treatment more effective.

Dentists are told that it has been found to do unusual things in medicine, especially in neuritis, neuralgia, myalgia, sciatica and lumbago, in gallbladder drainage and high blood pressure and in all of the various toxemias due to insufficient removal of wastes from the colon; besides alcoholism and many acute infections. The dentist is impressed with his duty to prescribe cathartics, if he would care for his patient systemically as well as locally.

Further:

Occy-Crystine is distinctly different. Its after effects are most decided. A feeling of well being, increased vigor, pep, good appetite and new ambition is marked. It is most marked in patients past middle life, from fifty years on. When nature has begun to slow up the gonadal

secretions, the rest of the ductless glands follow suit and the symptoms of senility begin to appear. Here is where Occy-Crystine starts to make history. The over-loaded liver is relieved, detoxication goes on rapidly and catabolic changes progress more vigorously. It is surprising to see the various functional inactivities rapidly changed about and replaced by a decided and definite normally behaved glandular system. Even in acute infections as pneumonia, tonsillitis, the exanthemata, thyroid, etc., a generous initial dose will rid the patient of much debris and stimulate nature's protective organism.

The dentist who hands out the clinical samples becomes the unwitting agent for dispensing such trash and does neither his patient nor himself a service. This is emphasized by the chemical findings, which show that Occy-Crystine is essentially nothing more than a solution of Epsom salt and sodium thiosulfate ("hypo"). Potassium salts are present in too small amounts to have any therapeutic significance and calcium was not found.

How a solution of Epsom salt and sodium thiosulfate acts to awaken slowed up gonads and other ductless glands is hard to discern in the light of available knowledge. The actions are laxative or cathartic, depending on the dose taken at one helping. The directions call for an ample intake of water. For children, it is to be taken in prune juice. The water and the prune juice may be more important than the amounts of salt in each dose.

The actions of Epsom salt as a hydrogogue cathartic need little discussion. In proper doses and in certain types of constipation, it is useful. As such, it has a legitimate though extremely limited place in dental practice.

Sodium thiosulfate ($Na_2S_2O_3$, the "hypo" of photographic developing solutions) is not generally used as a laxative or cathartic. It does not receive prominent attention as such in textbooks on pharmacology, although it has been suggested as a laxative. The claim that the sulfur would be liberated from Occy-Crystine when in contact with acids accords with the presence of thiosulfate, but there is no particular virtue to the resulting mixture of Epsom salt, sodium sulfite and free sulfur. The sulfur, if present in active amounts, would merely act as a laxative by virtue of its irritant action on the intestine. The sodium sulfite will, in all likelihood, be oxidized to sodium sulfate and thus exert a laxative or purgative action, this depending on the amount present. In any event, Occy-Crystine cannot be expected to do more than a solution of Epsom salt or of Glauber's salt. It is therefore needlessly complex.

The Council has already expressed itself on the attempts to urge dentists to foster indiscriminate habits of purging with expensive preparations of unknown composition. Dental journals which carry such advertising do not render a service to their readers. In its report on Sal-Hepatica, another hydrogogue cathartic, advertised through dentists, the Council pointed out:

> When the dentist feels that the use of a saline laxative or cathartic is desirable, there are a large number of official products available for this purpose. There are magnesium sulphate, sodium sulphate, citrate of magnesia solution, seidlitz powders and others which need not be detailed here. If he desires to prescribe an effervescent Glauber's salt, there is effervescent artificial Carlsbad salt, described in the National Formulary. Concluding a concise discussion of the salines and effervescent salines available for purging, Fantus (Useful Cathartics, Ed. 2, Chicago: American Medical Association Press, 1927, p. 87) writes:
>
> "In view of this abundance of satisfactory administration forms for salines, what justification is there for prescribing fancy-named products, whose only merit lies in clever advertising? An example of thoughtless recommendations of nostrums by physicians is "Sal Hepatica."
>
> Cathartics have their place, but it must be remembered that the cathartic must be fitted to the condition of the individual patient. Excesses in the use of these drugs are bound with immeasurable harm for cathartics are not only in a sense habit-forming drugs, but also, as in certain cases of intestinal obstruction, they may even kill the patient. The routine use of cathartics has no place in dentistry.

In view of the foregoing, Occy-Crystine is declared not acceptable for A.D.R. The chemist's report follows:

One original package of Occy-Crystine (Occy-Crystine, New York City), price $1.23, was purchased on the open market for examination.

The following appeared on the label:

A standardized hypertonic solution of sodium, magnesium, potassium and calcium salts.

The package contained 240 c.c. (8 ounces) of an odorless, colorless liquid. The specific gravity was 1.28 and the p_H 7.4.

Qualitative tests indicated the presence of magnesium, sodium, potassium, thiosulfate, sulfate and traces of chlorides. Phosphate and calcium were not found. In view of the statement that calcium was present, the following additional test for calcium was carried out.

Twenty-five cubic centimeters of Occy-Crystine was boiled with 10 c.c. of concentrated hydrochloric acid, and the separated sulfur filtered. The filtrate was made up to 1,000 c.c. A 25-c.c. portion was treated with 1 gm. of ammonium chloride and made alkaline with ammonium hydroxide and while it was boiling, 5 c.c. of ammonium oxalate T. S. were added. There was no precipitation nor turbidity. The addition of 1 drop of calcium chloride T. S. resulted in a marked turbidity, then precipitation.

Quantitative determinations yielded the following:

Residue (100 C.)	38.6 gm. per 100 c.c.
Ash (950 C.)	31.5 gm. per 100 c.c.
Sodium thiosulfate ($Na_2S_2O_3$)	20.4 gm. per 100 c.c.
Magnesium (Mg^{++})	3.0 gm. per 100 c.c.
Sodium (Na^+)	6.1 gm. per 100 c.c.
Potassium (K^+)	0.5 gm. per 100 c.c.
Sulfate (Mg^{++})	3.0 gm. per 100 c.c.
Chlorine (Cl^-)	0.03 gm. per 100 c.c.

It may be calculated, from the foregoing, that Occy-Crystine contains sodium thiosulfate, anhydrous, 20.4 gm., magnesium sulfate, anhydrous, 14.8 gm., and potassium sulfate, 1.0 gm. with a trace of chlorides per hundred cubic centimeters. A solution having the essential properties of Occy-Crystine may be prepared by dissolving sodium thiosulfate, U.S.P., 32 gm., and Epsom salt, U.S.P., 30 gm. in water to make 100 c.c.

Each teaspoonful of Occy-Crystine (4 c.c.) would contain: 1.3 gm. (20 grains) of sodium thiosulfate and 1.2 gm. (18 grains) of Epsom salt.

The following table shows the content of each important ingredient in the recommended doses:

	Sodium Thiosulfate U.S.P.	Epsom Salt U.S.P.
Small dose: ½ to 2 tspfuls.	10 to 40 grains	9 to 36 grains
Large dose: 1 to 3 tspfuls.	20 to 60 grains	18 to 54 grains
Children: 10 drops to 1 tspful.	3 to 20 grains	3 to 18 grains

BUREAU OF PUBLIC RELATIONS

A STUDY OF DENTAL CHANGES IN A GROUP OF PUEBLO INDIAN CHILDREN*

By S. S. ARNIM, D.D.S.; S. D. ABERLE and E. H. PITNEY, New Haven, Conn.

THE data in this report are based upon the clinical observations of the permanent and deciduous teeth of 204 Indian children. The group chosen for study includes all boys and girls 7 to 11 years of age enrolled in the government day schools of six Rio Grande Pueblo villages in New Mexico and three Hopi villages in Arizona.

REVIEW OF LITERATURE

Although there is much literature dealing with the incidence of caries in groups of children, few authors have actually recorded such data in a comparable manner. The children in the Mooseheart orphanage, from 10 to 17 years of age, were found to be 9.9 per cent free from caries. When the deciduous and permanent teeth are considered together, caries-free teeth are found to be present in from 9.9 to 31.6 per cent. Hypoplastic teeth were reported no more susceptible to dental caries than "normal appearing" teeth. These examinations were made with the aid of dental roentgenograms. (Hanke, 1933.[1]) Millberry[2] (1930), in his study of the dental problem in Hawaii, reports an average of 7.4 per cent cavities per child (age 4-12). Bunting's[3] study (1932) of 1,192 Michigan children, 5-15 years of age, shows 11 per cent free from decay. A large group of Negro children, 6-15 years of age, were examined by Sterling[4] (1928) and 31.6 per cent were reported free from dental caries.

With the percentage of deciduous and permanent caries-free teeth taken separately, Stoughton and Meaker[5] (1931) found the deciduous teeth free of caries in the following proportions: 13 per cent in groups at 6 years of age; 23 per cent in groups at 9 years, and 75 per cent in groups at 13 years. These authors found the permanent teeth of 1,183 children to be caries-free in 79 per cent of children of 6 years; in 31 per cent of children of 9 years, and in 15.1 per cent of children

*This investigation was subsidized by the Carnegie Corporation of New York and the Carnegie Institute of Washington. H. V. Smith, of the College of Agriculture and the Agricultural Experiment Station of the University of Arizona, made the chemical analysis of the water and J. G. Townsend, of the U. S. Public Health Service associated with the Office of Indian Affairs, assisted in the field.

1. Hanke, M. T.: Diet and Dental Health, University of Chicago Press, 1933.

2. Millberry, G. S.: Study of Dental Problem in Hawaii, University of California, College of Dentistry, Monograph, 1930.

3. Bunting, R. W.: Observations in Examination of Mouths of 1,192 Children in Public Schools and Institutes, J. D. Res., 12: 444 (June) 1932.

4. Sterling, E. B.: Health Studies of Negro Children, Pub. Health Rep., 43:2713-2744, 1928.

5. Stoughton, A. L., and Meaker, V. T.: Pub. Health Rep., 46:2608-2616, 1931.

of 13 years. Of the group of 451 children, aged 5-12, studied by Eliot *et al.*[6] (1934), 53 per cent showed some degree of caries in one or more permanent teeth. Cohen[7] (1936) reports approximately 80 per cent of lower first permanent molars carious at 10 years of age and 70 per cent of second lower deciduous molars carious at 3 years.

Studies of skulls by Leigh[8] (1925 and 1929) show an incidence of 25 per cent with caries among the California Indians of pre-Spanish or early post-Spanish epochs. He found that 75 per cent of Zuni skulls had one or more carious teeth, while skulls derived from the Sioux had an incidence of 11 per cent. Most of the lesions observed were in adults. Two cases of caries of the deciduous teeth were observed in the Zuni skulls. Attention is called to the fact that the Sioux were nomads and hunters, subsisting largely on a meat diet; while the Zunis practiced agriculture, and their diet is more closely comparable to ours.

It seems evident from the data presented by these authors that the incidence of caries in white children in the United States is high. The incidence in the Negro and Indian groups appears to be significantly low.

METHODS

The dental examinations of the Indian children were made with the aid of mouth mirror and explorer. The criteria employed in the identification of carious lesions were as follows: A tooth was considered to be carious when there were necrosis and débris associated with cavitation of that portion of the tooth exposed in the oral cavity. (Eliot,[6] 1934.) Teeth containing fillings were recorded as carious. All observable defects and the absence of such were recorded for each child. The observation of numerous opaque white spots in the enamel led to analyses of the water supply. The water from all nine settlements where the children lived was analyzed for fluorine. Although it was possible to obtain and have analyzed a fairly complete supply of drinking water from the villages in which the children lived, we cannot assume that any one child used a single source of water continuously throughout his life. New wells are constantly being developed by the government, and each child would drink water from several sources during the year. The well near the home, the water at school and the drinking supply at their summer homes or where working in the fields or herding sheep, was obtained from all nine villages.

RESULTS

Of the 204 children examined, 13 per cent were free from caries and 64.2 per cent had no caries of the permanent teeth. Of the 811 first molars, 114, or 12.7 per cent, were carious. Of the first molars, 206, or 24.1 per cent, had white spots in the enamel.

No white spots were seen in the deciduous teeth. Thirteen per cent of the children were free from caries of the deciduous teeth.

Water from Acomita, a New Mexico pueblo, contained 2.8 parts per million of fluorine, while that from Oraibi and Hotevilla, both Arizona pueblos, contained 1.2 and 1.1 parts per million respectively. Of the eighty-four permanent

6. Eliot, M. M.: Study of Teeth of Group of School Children Previously Examined for Rickets, Am. J. Dis. Child., 48:713-729 (Oct.) 1934.

7. Cohen, J. T.: Statistical Study of Caries in Deciduous and Permanent Teeth of Children, J.A.D.A., 23:312 (Feb.) 1936.

8. Leigh, R. W.: Indian Tribes of Varied Environmental and Food Conditions, Am. J. Physiol. & Anthropol., 8:179, 1925; Dental Pathology of Aboriginal California, D. Cosmos, 71:756 (Aug.) 1929.

central incisors examined at Acomita, fifty-four, or 64 per cent, had white spots in the enamel. In Oraibi and Hotevilla combined, twenty-one, or 0.92 per cent, of the 227 permanent central incisors examined had white spots. The water analyses from the other locations revealed less than 0.7 parts per million of fluorine. Of the 470 permanent central incisors examined in these Pueblos, 147, or 31.2 per cent, had white spots in the enamel.

COMMENT AND SUMMARY

The data presented reveal a much higher incidence of white spots in Acomita than in the other pueblos. This is, of course, a definite indication that the high fluorine content of the water at this location is associated with their occurrence, and, by deduction, that the very small quantities present in the other pueblos may account for all the lesions observed, despite Smith's[9] statement that mottling of enamel does not occur when less than from 0.9 to 1.0 parts per million of fluorine is present. Until adequate chemical and histologic studies are available on some of these teeth, one is forced to assume that, in all probability, the white spots are due to the presence of fluorine rather than to any specific dietary deficiency. The proposition arises of course that two conditions may be operating in the production of the lesions; namely, a combination of dietary deficiency and concentrations of fluorine too weak to be effective alone.

It is extremely interesting to compare the results obtained in this study with those reported in other groups.

In Eliot's[6] (1934) study, 47 per cent of the children, aged 5 to 12, had no caries of the permanent teeth, in contrast to the 64.2 per cent in this group. Only 12.7 per cent of the first molars of the Indians, aged 7 to 11, were carious, while 36 per cent were affected in the New Haven children. The Indian children had a lower incidence of decay than the New Haven group. When permanent and deciduous teeth were counted together, only 13 per cent of all the Pueblo Indian children studied were completely free; while Sterling reports 31.6 per cent of Negro children, and Bunting 11 per cent of white children, free of caries. The percentage of caries-free deciduous teeth (13 per cent) is comparable to that reported by Stoughton and Meaker.[5]

We are confronted with an extremely significant fact when we consider that no carious lesions were observed in the 1,605 permanent incisors. We know that 24 per cent of these teeth had white spots in the enamel. McKay[10] (1928), Williams[11] (1923) and others have stated that there is no increase in caries incidence in mottled teeth. The observations recorded herein add another group of teeth, structurally defective, in which the incidence of caries is not increased.

63 Trumbull Street.

9. Personal communication to the authors.

10. McKay, F. S.: Relation of Mottled Enamel to Caries, J.A.D.A., 15:1429 (Aug.) 1928.

11. Williams, J. L.: Mottled Enamel and Other Studies of Normal and Pathological Conditions of This Tissue, J. D. Res., 5:117-195 (Sept.) 1923.

ETHICAL PUBLICITY*

By EDMUND T. LANE, D.D.S., Washington, D. C.

THE subject of publicity has been avoided by most of the members of organized dentistry because they have believed that to inform the public about advances in dentistry would be bordering on advertising and would place them in the same class as unethical advertising dentists. The result has been silence on the subject, although every one believes that some method of educational information should be made available to all patients. As a result of this underlying sentiment, various members of dental societies throughout the country have, from time to time, been persuaded to express their views regarding advances in dentistry. Sometimes, these views have been poorly expressed and but little supported by scientific reasons. The result has been to make dentistry appear in a poor light in relation to other sciences. To illustrate my point, I call attention to the poorly managed publicity attending the announcement of the Hartman solution last year. The original manner in which this was given to the public was unscientific and expressions of opinion by the various members of the dental profession were also unscientific and, in many instances, unethical and self-glorifying. In publicity covering a subject of this type, we must at all times avoid individualism.

In order to avoid the recurrence of such a situation, the District of Columbia Dental Society has seen fit to create a standing committee on publicity with a chairman who is well qualified to deal with the press. By training and contact, he enjoys the respect and good will of the gentlemen of the "fourth estate." His appointment is for three years and he acts in the capacity of a public relations counselor for the District of Columbia Dental Society. The editors of all the papers in Washington have been advised by the society that any news relating to dentistry will be made available by this committee and such publicity will represent the official opinion of organized dentistry in the City of Washington. Thus any expression of an individual practitioner will represent his own opinion and not that of organized dentistry. This plan has created a very healthy situation between the newspapers and organized dentistry in Washington. They have a greater respect for our profession and realize as a result that dentistry is making scientific progress comparable to that of all other branches of science and that we are not a dead profession hanging onto the coattails of medicine. In fact, in certain branches of the healing art, dentistry is taking the lead and has been responsible for much progress. I refer specifically to the work done recently on calcium-phosphorus metabolism.

By facing the realities of this day and age, ethical publicity, or, shall we say? educational information, for the public, from the profession, is absolutely necessary; and in endeavoring to convey this information to the public by simple and organized methods, dentistry need not feel that it is returning to charlatanism and quackery, but rather that we are

*Read at a meeting of the Chester and Wilmington County Dental Societies, Westchester, Pa., Sept. 16, 1936.

making a step forward and upward to a higher plane of social responsibility.

By a lack of adequate publicity, through the past few years dentistry has been, in many instances, relegated to the luxury class; whereas, many former luxuries are now considered necessities; for example, radios and automobiles. How many laymen consider their irregular visits to their dentist just an occasion to have a tooth filled or to obtain relief from pain instead of an opportunity for having the mouth restored to its normal anatomic and healthy condition. We all try to impress on our patients the necessity of proper care of the mouth when we talk to them in the office; but this is not sufficient: we must further educational campaigns by means of the local press, radio and lectures before civic groups. In that way, we will reach a larger group and, at the same time, keep our profession constantly before the eyes of the public.

In my opinion, ethical publicity can best be handled as a local problem rather than a national problem. You will recall that, several years ago, one of the Presidents of the American Dental Association tried to establish a national procedure that would be workable and that his efforts met with considerable opposition. Understand, I do not advocate paid advertising or the buying of space to disseminate this information, thereby putting our publicity on a commercial plane; but rather the giving out of information in such a manner that it becomes of interest to the lay public and thus has news value and is entitled to space in the news section of our papers. As a local movement, supported and supervised by the men best suited to such purposes in the local societies, such publicity can be offered to the public by way of the press in a satisfactory and highly pleasing manner. Various parts of the country are endeavoring to work out a plan and their efforts should be observed and studied carefully by the national association, for, out of their experience, may evolve some general working plan that will be helpful to all local societies.

In Washington, we found two distinct methods of obtaining publicity. First, we approached the paper and interested the editor in the educational value of the material on hand, such as restoring facial contour by orthodontia and prosthodontia, and the psychologic effect on the growing child of uncorrected malocclusion and abnormal facial contour, etc. By use of actual photographs, in conjunction with drawings, we were able to lead the newspapers to publish an educational series of about ten articles explaining the advancement and accomplishments of modern dentistry. This series, if successful from a public interest standpoint, will be changed and run periodically.

The second method is obtaining publicity by means of current news. When a society has a scientific meeting with a speaker of national repute present, the community is naturally interested in the fact that the local dental profession is bringing scientific men from other parts of the country to give them the most recent advances of interest to the profession. This news can be presented to the papers in a very dignified manner and, at the same time, in a way that is comprehensive to the laymen. Thus, we let our patients know that we are always striving to improve our methods and to give them the best that the profession has to offer.

In the March, 1936, issue of *Readers Digest,* which undoubtedly many of you read, is an article on the subject of orthodontia, entitled "About Face," written in a style comprehensive to the layman of average intelligence. This publication, as we all know, exists entirely on its

revenue from subscribers, as it carries no paid advertising, and, therefore, the articles carried must be of great interest to the reading public. Now, if a publication of this type considers any subject in dentistry of interest, surely we should be able to obtain similar publicity on other subjects of interest and so continue such general publicity and not let a fine opportunity die. As we all know, sporadic publicity has never been especially beneficial in other fields, and neither will it be in ours. In publicizing the advances and accomplishments of modern dentistry, we must remember to avoid at all times any controversial subject and to publish only that which is correct and well established. In this way, we can avoid adverse publicity; that is, publishing information with which some dentists will disagree and thereby creating confusion and doubt in the minds of the laity.

The Bureau of Public Relations of the American Dental Association is prepared to supply material covering any phase of dentistry, all or any part of which would make interesting reading material for a newspaper.

How many phases of modern dentistry do you explain to your patients? Information which few lay people have and which they would be very much interested in obtaining through their local newspaper; for instance, rebuilding a tooth to its normal form instead of just filling it, restoring facial contour and facial expression by means of dentures or replacement of missing teeth by bridgework, removing lines from the face and restoring a youthful appearance by raising or opening the bite. These are a few of the things now being accomplished in modern dentistry with which the general public is not acquainted. These facts, along with many others of like importance, can be brought before the public by means of local newspapers.

In handling publicity for a postgraduate session or a meeting, where the plan is to have members of the press attend the sessions, do not expect the newspapermen to sit through a scientific lecture of two or three hours listening to material which means nothing to them and expect to obtain the maximum and most advantageous publicity. Instead, have the speakers available for the men of the press either just before or just after their papers and let the newspaper representatives interview these men in their own way. You will be surprised at the questions that will be asked, possibly having no bearing on the papers read, but on subjects most interesting to the layman. The newspaperman can tell just what part of the speaker's subject will interest the reading public and therefore be of most value to his paper.

PREVENTIVE DENTISTRY FOR CHILDREN*

By ISADORE TEICH, D.D.S., New York City

FOR generations past, parents have accepted decayed teeth with the pain and infections that accompany them as something unavoidable in children. Your children either get a toothache or they don't. So you do nothing about it until Junior keeps you awake a night or two with an aching molar and, in the morning, you take him to the dentist and out comes the offending tooth. Nothing further is done until the next toothache

*Radio talk.

develops and then, very probably, another tooth is lost. By the time our children become grown men and women, many of them are more or less dental cripples.

By now, the question may arise, "Is it possible to prevent toothache and the loss of teeth because of tooth decay?" The answer is an emphatic "Yes." It is possible to so care for your children's teeth that none of them will ever be lost; nor will they even occasion a toothache from decay.

I shall discuss a few of the things that can be done to prevent disease of children's teeth; for dental caries, which means tooth decay, is a disease. When I say "prevent dental caries," I do not mean that we can avoid the formation of the smallest cavity in a tooth. Unfortunately, at the present time, this is not quite possible; but we can prevent dental decay from causing the loss of teeth or even severely damaging them.

Let us first of all consider diet as a factor in the prevention of tooth decay. The foods your children eat are the materials their bodies use to build their tissues, among them the teeth. The hard parts of the teeth consist mainly of the salts of calcium and phosphorus. It is therefore necessary to feed children foods that are rich in these substances; i.e., milk, cheese, eggs, cabbage, lettuce and other vegetables. They also require vitamins to help them build strong teeth. Give them green leafed vegetables, orange, lemon and grapefruit juice and, during the winter months, cod liver oil, to supply vitamin D and the other vitamins it contains. Their meals should also contain a fair proportion of food hard enough to require chewing and make sure that they do chew their food completely before swallowing. Mastication of food is the function of the teeth and they, like the muscles of our bodies, must be used to insure proper development.

Just why should we use the toothbrush, and how important is it in the prevention of dental caries? The answer to these two questions becomes evident when we consider the process by which caries begins. Briefly, it can be stated as follows: Bacteria attach themselves to the surfaces of the teeth and are nourished by the small particles of food which remain around the teeth after meals. These bacteria produce acids, which dissolve the tooth enamel and, in this way, initiate the process of tooth decay. It is therefore apparent that by using the toothbrush after each meal, we can avoid the accumulation of food and bacteria on the teeth and so prevent dental caries. It is necessary to use the toothbrush properly. Sticking a toothbrush in the mouth and moving it around a few times is not enough. Each exposed surface of every tooth must be thoroughly brushed. To make this possible, the child should have a toothbrush with stiff bristles and of suitable size, so that every part of the mouth may be reached with it. There are definite toothbrushing methods which are designed to accomplish the desired results. If you are not familiar with one of them, consult your dentist and he will demonstrate a proper toothbrush technic for you.

Now let us consider another factor in the program of preventive dentistry for children: dental care of children's first teeth. Parents often neglect to have cavities in children's first teeth properly filled. They reason that since the first set of teeth will be lost by the time the child is about 12 years old, it is not necessary to be bothered with filling them. This, of course, is illogical. The child requires his full set of first teeth to do his chewing with, and if they are lost too soon because of decay or for other reasons, the dental apparatus is damaged and he is handicapped in masticating his food.

This, in turn, may cause digestive disturbances and undernourishment; for, when food is insufficiently masticated, it becomes impossible for the digestive processes to act on it and its full nutrient content is not made available for absorption. Another reason that the child's first teeth should be given care is that if they are allowed to become decayed, and no attention is given them, they will in time become abscessed. This condition is a definite threat to the child's health, as the toxins formed are absorbed by the blood and may cause injury to other parts of his body. The presence of a complete set of sound first teeth will, on the other hand, not only aid in digestion and the nourishment of the child, but will also encourage him to chew vigorously and help in the development of symmetrical facial contours. Vigorous chewing will also stimulate the growth and development of the jaws and thereby provide adequate space for the second teeth as they erupt. The premature loss of the first teeth is often responsible for the irregularity and crowding of the second teeth. So, as you see, it is essential to care for the child's first teeth even though they will be replaced at an early period in life.

The most important factor in the prevention of dental disease in children is a visit to the dentist at regular and frequent intervals, whether the child is suffering from toothache or not. How frequent these visits are to be depends on the degree of susceptibility or immunity the child has to dental caries. He should be taken to the dentist and, after the proper examination, the latter will determine how often during the year the child should visit him in order that he may effectively guard the dental health. The child should be taught to avail himself of the dentist's preventive service so that he will not require so much curative service.

We have often heard the admonition "Visit your dentist twice a year." This is even more important for children because of their greater susceptibility to dental caries. If the child is brought to the dentist often enough, the latter will be able to detect dental decay at its very beginning and check its progress before it has had a chance to do much harm. When decay is permitted to form a large cavity, the pulp, or nerve, which is located in the center of the tooth, is also injured and, as a result, may die, an abscess forming under the tooth. This is more liable to happen in children than in adults because children's teeth have larger pulps and, consequently, thinner tooth walls. Tooth decay is unlike other ailments, such as a cold or a headache, in that it does not cure itself. Once it has attacked a tooth, it will go on until the tooth is destroyed. Therefore, much is to be gained by taking the child to the dentist as often as he considers it necessary. In children, a greenish brown stain often forms on the teeth which is not only unsightly, but also injurious to the enamel. Frequent visits to the dentist will enable him to keep your children's teeth free of this stain and prevent tooth decay from this condition. Between the fifth and sixth year of life, four new teeth make their appearance in the mouth. Because these teeth erupt as early as they do, parents often mistake them for deciduous, or baby, teeth and expect them to be lost and replaced later on, as the other baby teeth are. These four teeth are not "baby" teeth: they are the first of the permanent teeth to erupt and are referred to as the first permanent molars. I use the term "permanent" with hesitancy; for, too often, these teeth are lost a very few years after eruption. We can make them permanent if we permit the dentist to give them the care they need. I make special mention of these teeth because

they play a very important rôle in the future well-being of all the teeth. They occupy key positions in the dental arches and guide the remaining teeth into proper relationship to each other. Teeth that occupy the proper position in the dental arch are so placed as to prevent impaction of food against the gums and to resist the forces of mastication without injury to the bone and gum around them. They are readily cleaned by the movements of the cheek, lips and tongue against their various surfaces and are easily reached by the toothbrush. All of these facts help to maintain a set of teeth with less susceptibility to decay and healthier gums than is the case when teeth occupy irregular positions in the dental arch. Do not permit a child's first permanent molars to be lost. Cooperate with the dentist in his effort to make these teeth really permanent. It is impossible to overemphasize the importance of frequent and regular visits to the dentist in any program of prevention of dental disease.

In conclusion, I wish to speak of the most effective and practical advance made in recent years in the field of preventive dentistry for children. If we look into the mouth of the child, we will note that the grinding surfaces of the back teeth are not flat, but are made up of cusps which slope toward the center of the tooth, forming grooves as they meet. Very often, at the bottom of these grooves, fissures are found, which are really cracks through the enamel. These fissures are the starting places of dental decay. Dr. Thaddeus P. Hyatt has conceived the idea that when such fissures are found in children's teeth, whether carious or not, they should be treated so as to prevent the onset and destruction of decay, which is sure to occur in these places. Treatment often consists of a slight widening of these fissures, the removal of any decay, and, finally, filling. This procedure is known as prophylactic odontotomy, which means the filling of teeth for preventive purposes. The practice of prophylactic odontotomy has saved countless numbers of teeth for children, and has saved countless numbers of children from the agonies of toothache. We all owe a debt of gratitude to Dr. Hyatt, who has been tireless in spreading the gospel of preventive dentistry for children.

SHOREWOOD DENTAL HEALTH PROGRAM

SHOREWOOD is a residential suburb of Milwaukee, Wis. Its population is 16,000. The health department is under the direction of the health board, which is appointed by the village president and the village board of trustees. The health department consists of four trustees and a clerk, all laymen, a physician and a dentist. The health department employs a part-time physician as health officer (not a member of the health board), three public health nurses, one dental hygienist and a stenographer. The dental member of the health department is the director of the dental division, and he serves without pay.

The total enrollment in the public and parochial elementary and high schools is 3,274.

The dental educational program, which was started in 1929, is based upon education, periodic mouth surveys and "follow-up." The program is conducted by the dental hygienist under the direc-

Material from the Bureau of Public Relations arranged as an exhibit in a Chicago bank window.

tion of the dental director. The educational material is graded according to the age level of the children. The mouth surveys are made by the hygienist in the dental health room in each school, at which time the children in groups of from seven to twelve are given toothbrushing instruction. All children who need dental attention, including correction of malocclusion, are reexamined every two weeks, until the case is finally disposed of. The parents are not notified regarding the number of cavities present, nor as to whether the cavities are in deciduous or in permanent teeth. No effort is made to diagnose, but only to see that the child in need of care consults the dentist.

When the program was first started, 78 per cent of the children needed dental care. Today, only 13 per cent need dental care. Recently, the program has been extended to reach the senior high school and the preschool group. During one year, 98 per cent of the preschool group had all dental defects corrected before entering school.

The cost of this efficient program to the village of Shorewood is the salary of one hygienist plus a little expense for educational material.

WINDOW DISPLAY

The window display shown on page 487, prepared by the Bureau of Public Relations, attracts the attention of all who pass the Lake Shore Trust and Savings Bank on North Michigan Avenue, Chicago.

Perhaps there is a bank or store window in your community that could use this or a similar display.

A.D.A. Radio Broadcasts Over Columbia Northwest Chain

Through the cooperation of the Columbia Broadcasting System, the American Dental Association's weekly radio programs are being made available to the following stations:

WOC Davenport, Iowa
KRMT Des Moines, Iowa
KSCJ Sioux City, Iowa
KFAB Lincoln and Omaha, Nebr.
WISN Milwaukee, Wis.
WCCO Minneapolis and St. Paul, Minn.
WMBD Peoria, Ill.
WNAX Yankton, S. D.

The subjects and dates for the coming month are as follows:

March 2: Ancient Egyptian Dentistry
March 9: Duchess Margaret
March 16: George Washington's Dental Troubles, I
March 23: George Washington's Dental Troubles, II
March 30: Early American Dentistry: Paul Revere and John Baker

DENTAL ECONOMICS

CONNECTICUT DENTAL HYGIENE PROGRAM

By F. M. ERLENBACH,* D.M.D., Hartford, Conn.

THE Connecticut State Department of Health has as one of its many activities the Division of Mouth Hygiene in the Bureau of Child Hygiene. The division's staff comprises a chief and four dental hygienists. All members of the division are employed full time and devote their entire effort to a purely educational program having as its aim prevention of defects and the referring of children to their family dentists for early correction of defects.

The educational program is not confined solely to the care of the oral cavity. The relationship between proper diet, sunshine, play, rest and fresh air and the formation and maintenance of healthy, strong bodies and healthy teeth free from caries is emphasized. Individual instruction in the mechanics of keeping the mouth—teeth, gums and tongue—clean and healthy, and prophylactic care, along with the charting of defective teeth, are added to forward early correction of existing defects.

Any discussion of the essentials of the division's program as it is now in operation must take account of its two phases, which are interdependent, educational and practical instruction. The educational phase emphasizes general health and resultant mouth health, to be achieved through correct health habits and proper dietary habits. Children and adults are taught something about the growth and development of the teeth and jaws, as well as of the benefits to be derived from early dental attention. Practical instruction includes toothbrush drills and prophylactic care. This demonstrative phase of the program is designed to make more compelling the precepts of mouth health that are being taught in principle in the educational activities of the division.

The educational part of the program is carried into mothers' clubs (prenatal group), and both parts are carried into well-child conferences (preschool group) and into the first three grades of the schools. In the schools, the service is intended principally for children in these grades, since prevention and early correction is more pertinent and will produce more lasting effects in the younger age groups. At the request of the teachers and principals of schools in which the work was being done, the educational program was extended to include talks and drills for the higher age groups. At the request of the teachers and principals of schools in which the work was being done, the educational program was extended to include talks and drills for the higher age groups. The following four precepts are stressed in the talks: 1. Drink plenty of milk and eat fresh fruits and vegetables for strong, healthy teeth. 2. Brush your teeth at least twice a day. 3. Get plenty of rest, sleep and fresh air. 4. See your dentist at least twice a year.

In connection with the school work, we have made a contact with the mothers

*Chief, State Department of Health of Connecticut.

of children who have received this service. Many mothers are interested enough to come in a group to hear talks on mouth health. The interest evinced by the mothers has been encouraging, and it is hoped that, as a result of these contacts, much pressing remedial work will be done.

Other adult groups interested in mouth health are reached through lectures which emphasize the educational points that are stressed to the children and their mothers, prevention and early correction of defects. After these lectures, there is often a demand for the work of the staff. The program uses follow-up talks, often with a dental film, urging that remedial work be done and showing the great necessity for such work and the costliness of delay.

The program of the division of mouth hygiene in its extended form (since the advent of Social Security) has been in operation a relatively short time. The statistical data which have been collected are as yet insufficient to show significant facts about "mouth health in Connecticut," but the eagerness and appreciation of the people whom the program reaches would indicate that they are on the road to better oral health.

MILWAUKEE HEALTH DEPARTMENT DENTAL HYGIENE PROGRAM

DENTAL EDUCATIONAL PROGRAM

THE dental educational program of Milwaukee, Wis., which is carried out by the dental hygienists of that city, consists of the following:

1. Mouth examinations of all children in the kindergarten and first four grades.
2. Lectures, with movies or slides, on diet, cleanliness and home care as related to a sound healthy mouth and teeth. (This service is given to all elementary school children.)
3. Toothbrushing instructions and sale of toothbrushes in all the classrooms.
4. Prophylactic service for all children in the second and third grades, if such service was not given on the previous visit of the dental hygienist.
5. Sending of defect notices to parents.

Prior to the hygienist's visit, the school is sent a package of small buff colored and large white cards. The buff colored cards are called dental defect notices. Each teacher in the kindergarten and in the first four grades is asked to enter the names of the children in her class on these cards. These cards are given to the children immediately before their dental examination. After the hygienists have examined the teeth of all the children in the kindergarten and in the first four grades, they fill out these defect notices more completely and send them home by the children to the parents.

On the large white cards, the permanent dental record cards, are recorded all pathologic oral conditions present when the examinations are made. These cards are kept filed in the envelops containing the records of the child's physical examination. Teachers are asked to fill out these cards before the time scheduled for the dental hygienist's visit. The kindergarten teachers are asked to fill in, on these cards, the name, grade, age and room number of *all* the children in their rooms. The teachers in the first four grades are asked to fill out these white cards for those children not already having one in the physical data envelop.

DENTAL HEALTH CLINICS OPERATED BY MILWAUKEE HEALTH DEPARTMENT: OPERATIVE PROGRAM

The Milwaukee Health Department operates three dental clinics for the care and treatment of indigent school children.

All cases admitted to the dental clinic must be registered for free dental care by the school nurses, as follows:

When following dental cases into the home, cases referred to the nurse by the school physicians or by the dentist member of the dental hygiene teams, or dental hygienist, the nurse first ascertains the financial circumstances of the family. If the family is indigent, she registers the case for care at one of the three health department clinics or refers the case to the Milwaukee Children's Hospital or the county dispensary clinics.

The time of the operating dentists at the clinic is divided into four periods, from 9 to 10:30, and from 10:30 to 12 in the morning, and from 1:30 to 3 and from 3 to 4:30 in the afternoon. Each nurse is assigned one of these periods and brings in her cases at a particular time on a definite day each week to the dental clinic in her district. Each nurse has one dental clinic period one and a half hours each week, at which she is expected to bring in some of her indigent school cases requiring dental care.

The nurse calls for the children at the school, takes them to the clinic and returns them to the school. While at the clinic, she assists the dental operator at the chair and handles the record work on her cases, etc.

Extensive operative work is limited to children under 12 years of age. Only badly infected teeth in cases of children over 12 years that come to the clinic as emergency cases are cared for.

Indigent children with toothache requiring the care of the dentist are always given immediate care at the clinics. The principal may send, or a parent may bring, a child suffering with an acute toothache to the clinic provided the child is not then under the care of a dentist or the family does not regularly employ a dentist. No child is ever taken to the dental clinics for any work except with the signed consent of the parent. The consent slip is filed with the child's dental record in the dental clinic.

Each child admitted to the clinic as a regular patient receives the customary dental care, consisting of cement and silver fillings, treatments, prophylactic care and extractions. No gold fillings or inlays, crowns or bridgework are ever placed in the health department clinics. Extractions under gas are performed twice each week. A physician on duty at each clinic examines all children prior to their taking gas.

This complete dental service is given to each child only once during the period of his eligibility as a dental patient in the clinics, with this exception: Children brought to the clinics for regular care before the first permanent molars have erupted are given complete dental care at any time before the ninth year. Children between the ages of 9 and 12 years making their first trip to the dental clinic for routine care are given the complete service, but may not be again returned to the clinic. In other words, all children who have received routine care at one of the dental clinics are not eligible for it again, except when such a visit is scheduled before the child has completed the eighth year. Emergency care is given when needed.

This policy limits the number of children who may return for routine service in the dental clinics. It better enables the department to take care of the younger children, to preserve their teeth and guard

them against serious dental infection. It also extends the scope of treatment to a greater number of children.

The following is a list of the members of the staff who are engaged in dental activities as carried on by the health department:

1 dental director, half time.

2 operating dentists, half time (10 months).

3 operating dentists, full time.

5 dental hygienists (two of them dentists), three-fourths time (9½ months).

The full-time operating dentists are on duty from 8 to 5 with one hour for lunch, five days of the week.

CCC DENTAL SERVICE

Dental service rendered to the men enrolled in the Civilian Conservation Corps has recently been greatly augmented, as evidenced by the following War Department orders:

December 3, 1936 CCW/ALC
A. G. 324.5 CCC
IMMEDIATE ACTION
SUBJECT: Dental Services, CCC.
The Commanding General,
First Corps Area.

1. The Director, Emergency Conservation Work, has approved a plan for the improvement of dental service to enrollees of the Civilian Conservation Corps.

2. You are authorized to organize, in your Corps Area, dental teams in the numbers specified in the table shown below:

Corps Area	*Dental Teams*
1st	10
2nd	12
3rd	17
4th	28
5th	14
6th	18
7th	22
8th	20
9th	27
Total	168

3. Each team will consist of a Reserve Dental Officer below the grade of Major, one enrollee as dental assistant and one enrollee as truck driver and orderly for the dental officer. The equipment of each team will consist of one truck to be taken from storage if necessary, and one set of field dental chests. It is desired that a team visit each company at least every six months, remaining for a period of approximately two weeks.

4. While visiting a company the dental officer will give such treatment during the two weeks' visit as will relieve emergency cases and give treatment to other cases in such a manner that all enrollees requiring dental treatment will have been given some relief commensurate with that possible during the period the dental team is at the camp. Dentures and bridgework will not be attempted. The services of the dental officer will be confined to enrollees exclusively, except where during his visit it may become necessary to give treatments to relieve pain for other personnel stationed at the camp.

5. Changes in Paragraph 92 *a*(3) and Paragraph 93, War Department CCC Regulations, May 15, 1935, will issue shortly to conform to the above.

6. Where in a Corps Area applications from Reserve officers for this duty are insufficient to supply the demand the Corps Area Commander will, before engaging the services of a civilian dentist, make requests for Reserve officers on other Corps Areas.

7. The Surgeon General will issue the necessary field dental sets upon requisition and without charge against Corps Area allotments.

8. It is desired that these dental officers

travel on a mileage status where such procedure will involve less expense to the Government.

By order of the Secretary of War:

Wm E. Bargin,
Adjutant General.

CCW/JCF
December 31, 1936

AG 324.5 CCC
(12-29-36) (Misc.)C
SUBJECT: Dental Service, CCC.
To: Commanding General,
First Corps Area,
Boston, Massachusetts.

1. Dental Reserve Officers selected for duty at CCC camps, referred to in the letter AG 324.5 CCC (12-2-36) (Misc. C.), above subject, dated December 3, 1936, will, upon arrival at a camp, report to the commanding officer, secure a suitable place in which to operate, and make provisions for a dental survey of all enrollees and an instruction talk on oral hygiene and care of the mouth and teeth. Dental treatment will be given to all emergency cases and to such other cases, including those requiring amalgam and cement fillings and treatment of infectious conditions, as time and the number of cases requiring treatment will permit. The materials used will be limited to those supplied in the equipment furnished.

2. Although the War Department letter cited above provides for periodic dental service at CCC camps, it may at times be necessary to engage civilian dental service on a fee basis. Under the provisions of paragraph 92 *a* (3), War Department Regulations, CCC, May 15, 1935, civilian dentists will be so employed only for individual cases in emergency. "In emergency" refers to an acute situation involving suffering and also implies that assigned dental officers or suitable Army facilities are not reasonably available. The work undertaken by dentists on a fee basis may include the treatment of inflamed gums and treatment or extraction of carious teeth, but will not include permanent fillings nor the replacement of lost teeth (except those lost from injury incurred in the performance of duty and previously approved for replacements by the Surgeon General). In order to suppress pain, the engaged dentist may fill the cavity of an aching tooth having an inflamed pulp with a medicinal preparation, such as a mixture of zinc oxide and eugenol, but such procedure will be classed as treatment and not as filling in the submitted voucher.

By order of the Secretary of War:

B. Y. Read,
Adjutant General.

WAR DEPARTMENT REGULATIONS

Relief of Unemployment, Civilian Conservation Corps

Changes No. 59 — WAR DEPARTMENT, Washington, January 5, 1937

War Department Regulations—Relief of Unemployment, Civilian Conservation Corps, May 15, 1935, is changed as follows:

19. Eligibility for enrollment and reenrollment.

* * * * *

d. To qualify for reenrollment a present member of the Civilian Conservation Corps must be—

* * * * *

(3) Considered worthy of reenrollment. See paragraph 26*c*.

(4) *Under 29 years of age, if a junior; i. e., must not have passed his twenty-ninth birthday.*

(5) Unmarried if a junior.

92. Personnel.—***

a. At reconditioning and work camps.

* * * * *

(3) Officers of the Dental Reserve Corps may be *placed on active duty and civilian dentists on a contract basis may be employed within the number elsewhere authorized for the various corps areas.* Employment of *civilian* dentists on a fee basis is authorized only for individual cases in emergency.

* * * * *

93. Medical attendance and hospitalization.—*a* A duly enrolled member * * *. Medical care will not include definitive treatment for long-continued cases, elective surgical operations, or dental work other

than *that authorized by instructions from the War Department.* When hospitalization is required, Army, Navy, United States, Public Health, Indian, and Veterans' Administration hospitals will be used if available and in the vicinity of Civilian Conservation Corps camps. If such hospitals are not available, hospitalization and medical attendance will be arranged for by corps area commanders in civilian hospitals at the expense of emergency conservation funds allocated to the Surgeon General.

* * * * *

d. Civilian physicians, dentists, nurses, foresters, educational directors, and other civilians employed in connection with the Civilian Conservation Corps are not eligible for treatment at the expense of emergency conservation funds. However, strictly emergency treatment, and such routine treatment of injuries which fall within the scope of the Federal Employees' Compensation Act and which does not interfere with the normal work of the medical officers, physicians, *and dentists* on duty, may be provided at camp dispensaries for such personnel. Other medical *and dental* service must be provided by those agencies which normally care for such personnel.

* * * * *

Julius Rosenwald Fund Discontinues Department of Medical Service

The Julius Rosenwald Fund which has for some years been devoting itself largely to problems of medical care has just issued a bulletin indicating its plans for the future. It will be observed that the Fund is officially discontinuing its department of medical service but that at the same time, as a parting gesture, it establishes a Committee on Research in Medical Economics to function over a period of five years and to devote itself to many different aspects of medical care. The exact statement of the Julius Rosenwald Fund follows:

"Julius Rosenwald Fund Grants $165,000 for Medical Economic Studies

"The Julius Rosenwald Fund has made a grant of $165,000 over a five year period to the Committee on Research in Medical Economics, it was announced yesterday by Edwin R. Embree, president of the Fund. This committee has recently been incorporated in New York with Michael M. Davis as chairman, the other members being Robert E. Chaddock, professor of statistics, Columbia University; Henry S. Dennison, president, Dennison Manufacturing Company, Framingham, Mass.; Walton H. Hamilton, professor of law, Yale University, and director, Bureau of Research, Social Security Board, Washington; Alvin S. Johnson, director, New School for Social Research, New York; Paul U. Kellogg, editor, the *Survey Graphic,* New York; Harry A. Millis, professor of economics, University of Chicago; Fred M. Stein, retired banker, New York.

"The committee will have an advisory board, to be enlarged as required, the following physicians now being members: Samuel Bradbury, M.D., Philadelphia; Alfred E. Cohn, M.D., New York; Alice Hamilton, M.D., Washington; Ludvig Hektoen, M.D., Chicago, and Franklin C. McLean, M.D., Chicago.

"This committee will conduct and assist studies in the economic and social aspects of medical care, will train personnel for this field, and, in cooperation with the medical profession and other agencies, will furnish information and consultation services in behalf of rendering medical care more widely available to the people at costs within their means. The committee will have headquarters in New York City.

"Since 1928, Mr. Embree stated, 'the Julius Rosenwald Fund has been actively at work with the aim of reducing the costs of medical services and of making them more accessible to people of small incomes. Now the organized medical profession, hospitals and many industrial and governmental agencies are engaged in practical experiments in different parts of the country, organizing medical care to reduce costs or developing methods of getting these costs into the family budget.

" 'Hence there is now less need for the promotion of action than for the guidance of action through scientific and dispassionate studies. The Fund therefore welcomes

the opportunity to make a grant of this kind to a committee of social scientists and business men, with a distinguished medical advisory board. With this grant, together with the grant of $100,000 recently made to the American Hospital Association to promote voluntary hospital insurance, the trustees have terminated their department of medical services, believing that these two agencies will now carry forward vigorously the Fund's long standing and successful work in this field.'

"Michael M. Davis, who is chairman and the active director of the new committee, has been since 1928 the director of the Fund's department of medical services. He has been associated for many years with work in medical economics and with hospitals and clinics in New York, Boston and Chicago, is the author of a number of books and many articles, chairman of the council of the American Hospital Association, and activ in numerous national public health and welfare agencies."—*J.A.M.A.*, Jan. 30, 1937.

Dental Trailer

The Hospital Division (United States Public Health Service) is displaying a traveling dental unit to be placed in the Coast Guard Service. A complete dental clinic is housed in a modern trailer, and includes x-ray equipment, laboratory and sterilizer, as well as the patient's chair and all the necessary electrical equipment. Electricity is obtained by plugging in from the outside. The new unit will be used to take dental care to inaccessible Coast Guard stations.—*Health Officer*, December, 1936.

Iowa Bureau of Mouth Hygiene

January 1, O. E. Hoffman, D.D.S., was appointed chief of the Iowa State Health Department's new bureau of mouth hygiene. The bureau, financed by Social Security Funds, will permit an enlargement of the Iowa dental health educational plan, which has proved successful for the past ten years.

Socialized Dentistry to Be Discussed at Meeting in May of New York State Dental Society

Socialized dentistry will be considered in all its implications when the dentists of New York, as well as from the nearby states of Pennsylvania and New Jersey and from New England, meet in May at the Sixty-Ninth Annual Meeting of the Dental Society of the State of New York. Sessions will be held at the Waldorf-Astoria, New York City. D. Austin Sniffen, of White Plains, president of the society, in making this announcement, said that the question of socialized dentistry must be met by the dental profession. "Our meeting in May," he said, "will be attended by more than 5,000 dentists. It offers an opportunity for a representative declaration of opinion on a road which organized dentistry needs to follow. It should be noted that the ethical basis of dentistry, like that of medicine, is comprised of rules that comprehend the best possible service for all the people. It is from that standpoint that the question of socialized dentistry must be approached."

Congress of the Allied Professions

Dentists will join with physicians, nurses, social workers and pharmacists from all over the Northwest who will gather in St. Paul for the Congress of the Allied Professions which will feature the eighty-fourth annual meeting of the Minnesota State Medical Association to be held in the St. Paul Auditorium, May 3, 4 and 5. A member of the dental profession is expected to address the Congress, which will open May 3, and continue throughout the day. A large public health meeting in the evening will climax the Congress. Among the medical men who will speak before the Congress are: Maxwell J. Lick, Erie, Pa., president of the Pennsylvania State Medical Society; Morris Fishbein, Chicago, editor of *The Journal of the American Medical Association*, and Father Alphonse M. Schwitalla, St. Louis, president of the Catholic Hospital Association. Washington representatives of the Social Security Board, the United States Public Health Service and WPA will also be present to discuss aspects of national welfare activities as they affect the practice of the professions. Representatives of the other allied professions will also address the congress.

CURRENT LITERATURE

Changes in Dimensions and Form of Face and Head with Age (M. S. Goldstein, Am. J. Anthropol., 22:37 [Oct.-Dec.] 1936): Detailed anthropometric observations were made on the heads and faces of subjects at from 2.5 to 3.5 years and every other year thereafter until from 20.5 to 21.5 years. It was found that the growth of the head is completed first, then the width of the face and lastly the length and depth of the face. The greatest growth of the head and face is in length. In depth the lower portion progresses more rapidly than the upper. The characteristics of growth in the head and face are: a peak between 3 and 5 years, usually continuous decrease in increment until about the 13-15 year and retardation until cessation of growth, at about 21 years. The heads and faces of fifty old Jewish men were also measured and showed definite diminution from average measurements of some dimensions, but not in others. Absolute variability tends to increase with individual age. It is relatively highest in vertical aspects of the face, less transversely and least in depth. Profile projections were compared with measurements. The writer claims remarkable correspondence with Hellman's data. The profile projections of the upper face of man, chimpanzee and orang-utan at various stages of dentition were compared. The author also compared his data with comparable existing data on the Negro, Chinese and Japanese. It was noted that at 3 years, there is slight difference in the width of nose in whites and Negroes, but the difference increases rapidly thereafter until the seventeenth year. Adolescent acceleration of growth was noted in the face of the Negro as well as the white.

GRANT VANHUYSEN.

Changes in Molar Teeth and Supporting Structures of Rats Following Extraction of Upper Right First and Second Molars (B. G. Anderson, A. H. Smith, S. S. Arnim and A. U. Orten, Yale J. Biol. & Med., 9:189 [Dec.] 1936): In order to study the effect of wear on the incidence of "cusp lesions" observed in animals on a low-salt diet, the upper right first and second molars of young rats were extracted. Some of the animals were placed on an adequate diet, others on a low-salt ration and, after death, the jaws were examined histologically. Results showed that mechanical disturbance of occlusion produces widespread changes in the dental structures. The cusp lesions, with fracture of the denture, were observed only in the cusps showing attrition in low-salt ration animals. Pulpal changes were most marked in the lower right first and second molars (nonoccluding) and structural changes in the alveolar process and gingivae were more pronounced on the right side. These changes were more severe in the rats on an inadequate diet, although they were observed in both series of animals. The fact that these widespread changes were seen only in rats with extracted molars indicates that alterations in masticatory stress and strain may have far-reaching effects.

HAMILTON ROBINSON.

Cancer of Lip (Wile, J., and Hand, E. A., J.A.M.A., 108:875 [Jan. 30] 1937): The authors report a study of 425 cases of carcinoma of the lip, mostly of the papillary, superficial, elevated type and the ulcerative infiltrative type. Most frequent in this series was the papillary type, which normally began from a keratosis or leukoplakia. This type remains locally malignant for some time and then extends slowly, finally metastasizing and ulcerating late in its course. The ulcerative infiltrative type commonly begins from a fissure, a secondarily infected cut, a minor injury or a chronic ulcer. These lesions ulcerate, break down and have an early tendency to metastasize. Of the series of 425 cases, 96

per cent occurred in males; 93 per cent in the lower lip, 4.7 per cent in the upper lip and 2 per cent at the angle of the mouth. The average age was 65.2. Thirty-two per cent smoked moderately or excessively and 4 per cent had syphilis. In 26 per cent, there was recurrence. The authors conclude that smoking is of some importance in the background of cancer of the lip; that precancerous lesions, such as keratosis, leukoplakia and fissures should be considered potentially malignant, that early treatment of cancer of the lip assures a high percentage of cures if the lesion is completely destroyed. Results of early cancer of the lip in this series were excellent, with local destruction or with surgical removal plus dissection of regional lymph nodes; and were good with surgical excision alone or with radium therapy, but were only fair with roentgen therapy. Early cases were best treated by local destruction; advanced cases by surgical excision. Results in far advanced cases were extremely poor.

M. K. Hine.

Salivary Calculi: Treatment by Catheterization and Dilation of Duct (H. C. Ballon and D. H. Ballon, Surg., Gynec. & Obst., 64:226 [Feb. 1] 1937): Calculi in the salivary glands or their ducts producing symptoms should be removed in most cases. An incision in the duct or excision of the gland is the usual procedure. Associated trismus or severe infection in the gland may necessitate delay. Ivy and others have pointed out that the primary object of the treatment is the relief of the obstruction to the flow of saliva, which is the cause of great pain. With repeated catheterization and dilatation of the duct, the stone often will be expelled. The authors give the diagnosis and treatment of four cases.

J. Frank Hall.

Adamantinoma of Jaw (R. H. Ivy and L. Curtis, Ann. Surg., 105:125 [Jan.] 1937): This report is a study of sixteen cases of adamantinoma of which fifteen were in the mandible; seven in males, nine in females; eleven in white patients and five in negro patients. The authors give the etiologic factors involved and also the symptoms and diagnosis. A chart and discussion show the differences between the epithelial tumors and cysts of the dental system. Other conditions of the jaws clinically resembling adamantinoma are discussed. The treatments employed in these cases were conservative enucleation, conservative enucleation followed by radium and primary complete resection without loss of continuity of the jaw. The authors present three case histories and conclude that primary complete resection is the method of choice in the great majority of cases.

M. W. McCrea.

Antiseptics (R. N. Nye, J.A.M.A., 108: 280 [Jan. 23] 1937): A report is made of the relative *in vitro* activity of sixteen different solutions being used today as antiseptics for minor wounds and abrasions. The author, believing that the bactericidal powers of drugs should be tested under conditions similar to those found in actual wounds, so devised tests with that in mind. Four solutions containing iodine (compound solution of iodine U.S.P. in three dilutions and a nonalcoholic iodine solution), seven containing mercury (metaphen, merthiolate, mercurochrome and others), two solutions containing chlorine (zonite and Apco No. 25) and also hexylresorcinol, listerine, and pepsodent were tested for bactericidal activity, bactericidal activity in the presence of 50 per cent horse serum, diffusibility and toxicity. The author concludes that this group of experiments shows the superiority of aqueous solutions of iodine, for iodine is the only antiseptic potent in the presence of 50 per cent serum. It is diffusible, not unduly toxic and is inexpensive. It is suggested that a 1 per cent or even 0.5 per cent aqueous solution of iodine (containing the necessary amount of potassium iodide for solution) can be used to advantage in wounds and for irrigations.

M. K. Hine.

Innervation of Peridental Membrane (W. Lewinsky and O. Stewart, J. Anat., 71:98 [Oct.] 1936): A short review is given of the more recent publications. The

authors used the Cajal silver nitrate method; from which sections, camera lucida reconstructions were made in order to follow the entire nerve fibers. Fibers innervating the peridental membrane arise near the apex of the tooth and proceed gingivally in company with the blood vessels. Many of the fibers possess a small knoblike ending, but some end as free endings. The fibers divide dichotomously near their termination. No fibers were traced into the cementum, but recurrent loops were noted as fibers approached the root. The nerve rings described by Van der Sprenkel were not seen by the authors. Human material was used throughout the work.

M. W. McCrea.

Experiments on Maintenance of Mineral Density in Skeleton (Y. A. Venar and T. Wingate Todd, J. Lab. & Clin. Med., 22:221 [Dec.] 1936): A series of experiments on growing bone *in vitro* were devised to determine the effects of vitamin D and calcium concentration on mineral density. The experiments demonstrate that (1) aqueous preparations of vitamin D favorably influence the extent and density of mineralization of rachitic bone fragments immersed in a solution of organic calcium, (2) in the presence of constant amounts of vitamin D, variation of the organic calcium concentration is reflected by corresponding variations in extent and density of mineralization in growing bone, and (3) in the presence of a constant organic calcium concentration, variations in the vitamin D content does not produce corresponding effects on the mineralization. The authors point out that these studies are on growing areas of bone only and specific studies must be devised for other bone areas.

Hamilton Robinson.

Management of Facial Injuries Caused by Motor Accidents (C. L. Straith, J.A.M.A., 108:101 [Jan. 9] 1937): In the short time that the automobile has been popular, it has brought about more casualties in the United States than all the wars in which this country has been engaged. In 1935, motor car accidents caused 36,000 deaths. More tragic than sudden death is the suffering borne by the injured through the immediate period of pain and disability and the years of mental agony of those left with lasting conspicuous facial disfigurements. The author divides facial injuries resulting from motor accidents into two general distinctive types: (1) injuries to the driver ("steering post" injuries) and (2) "guest passenger" injuries. "Driver injuries" are less common and are usually laceration and contusion of chin associated with fracture of the mandible (symphysis, neck of condyle, etc.). In some instances, the maxilla received the brunt of the blow. Seventy-five per cent of the severe, crushing facial injuries from auto accidents are inflicted on the "guest passengers," who are thrown forward violently and strike the instrument panel. The midportion of the face is usually crushed. The author recommends the following procedure: (1) careful inspection and cleansing of all lacerations, with removal of gross foreign bodies; (2) careful palpation of all facial bones; (3) palpation of the nose and intranasal inspection, and (4) inspection and palpation of the oral cavity. Every precaution should be taken to prevent infection. If infection occurs, plastic procedures should not be undertaken until two months after infection has disappeared. Every effort from start to finish should be directed toward conserving tissue and minimizing scar formation.

M. K. Hine.

Studies on Apices of Teeth, Part I (L. W. Burket, Yale J. Biol. & Med., 9:271 [Jan.] 1937): A correlated study of the bacteriologic, roentgenologic and gross anatomic findings in human jaws at necropsy is presented. The author objects to the methods of previous investigators in using extracted teeth on the grounds of possible oral contamination and to external approach methods because of difficulty in obtaining permission to examine control teeth and limitation to single-rooted teeth. In the present study, blocks containing the teeth and surrounding structure were removed from the jaws of patients at nec-

ropsy, the teeth were examined roentgenographically before and after removal, periapical cultures were made through a small window in the bone and the block was sectioned serially for histologic study. More or less complete histories were available in the hospital records, and this, together with the necropsy report, was correlated with the oral findings. One hundred and thirty-eight cases were studied with from one to eleven teeth removed from each patient. Part II is to appear in the *Yale Journal of Biology and Medicine*, March, 1937.

Actinomycosis (J.A.M.A., 108:226 [Jan. 16] 1937): A physician from Alabama sent in this interesting case history. A white man, aged 35, in 1930 had an acute swelling with pain in his face and jaw immediately after a tooth had been extracted. A few months later, this had progressed to a point of localized pus formation and, since that time, numerous usually superficial abscesses have been opened and drained. Repeated examinations of pus have failed to demonstrate organisms other than the usual pyogenic bacteria. About two years ago, a diagnosis of actinomycosis was made at a clinic and roentgen-ray treatment and large doses of iodine were given. The local condition has improved considerably, but there are occasional superficial abscesses there. Roentgenograms reveal no pathologic changes except superficial periosteal involvement. Eighteen months ago, the patient developed lobar pneumonia, which ran an average course and subsided by lysis. When convalescence was apparently well established, there was a recrudescence of fever, pleuritic pains, etc., in the involved lung. Roentgen-ray examination suggested mediastinum involvement and a small amount of free pleural fluid. This was considered actinomycotic and several series of high voltage roentgen-ray treatments were given. Since then, there had been more or less pain in the right chest, weakness and coughing. About three months ago, several abscesses developed in the anterior right chest, which were opened and remained as draining sinuses. Repeated examination of pus revealed no actinomycosis. Throughout all this time, the patient's condition had been very good. Lately, he had been losing weight and had a progressive anemia and mild leukocytosis. The editor comments that the sequence of events apparently represents extension of the actinomycotic process to the mediastinum and respiratory apparatus and apparently the lumbar spine. Although this would be decidedly unusual, the extension may have taken place through the lymphatic tract with such extensive disease that it is not likely that any method of treatment can result in cure, although radiotherapy and subtolerant doses of iodides might improve the patient's condition.

M. K. HINE.

FOREIGN LITERATURE

Calcium Metabolism and Pregnancy (R. Malmejac, Bull. Soc. Gynec., October, 1936, p. 575; abstr. Brit. M. J., 1:14 [Jan. 2] 1937): The fetus, toward the end of pregnancy, demands 1 to 6 gm. of calcium daily, while the average maternal diet furnishes only 0.25 gm. daily. A neglected calcium balance may lead to dental caries, osteoporosis and defective lactation. Toxic conditions of pregnancy are to be attributed in part to deficient calcium intake. Parathyroid extract and vitamin D therapy and ultraviolet radiations are useful adjuvant corrective measures. The diet of pregnancy, besides being rich in calcium, should contain milk, eggs and butter. Lactic fermentation, by rendering the intestinal contents acid, prevents formation of insoluble carbonates, phosphates and soaps of lime, and favors assimilation of calcium.

J. FRANK HALL.

MISCELLANY

CORRESPONDENCE

Louisville University and Flood Conditions

To the Editor: I have received so many inquiries regarding the effect of the flood on the building and equipment of the School of Dentistry that I would very much appreciate your announcing in The Journal that the School of Dentistry of the University of Louisville was but slightly affected. Classes will be resumed on February 8.

You might be interested in receiving in a few days information as to the part played by dentists and dental students in flood relief work. This I will try to send to you.

Much could be written regarding the assistance which Louisville received from all parts of the United States. It was one of the greatest manifestations of the true American spirit that I have ever seen. I shall write you more about it when I have time.

J. T. O'Rourke, *Dean.*

Feb. 5, 1937

NEWS

Deaths

Burnham, Silas S., Salt Lake City, Utah, School of Dentistry, University of Denver, 1912; died January 17; aged 54. Dr. Burnham served on the Utah State Board of Health, 1921-1927.

Carr, Oliver F., Beverly, Mass.; died November 12.

Conroy, John Keane, Belleville, Ill.; St. Louis University, School of Dentistry, 1900; died of pneumonia, December 21; aged 66. Dr. Conroy was a past-president of the Illinois State Dental Society.

Erwin, C. W., La Grande, Ore.; Northwestern University Dental School, 1906; died December 25; aged 53.

Hotchkiss, John W., Attleboro, Mass.; Baltimore College of Dental Surgery, University of Maryland, 1905; died December 15.

MacLeod, Alexander S., Lowell, Mass.; Tufts College Dental School, 1902; died December 25.

Mrazek, Lawrence W., St. Louis, Mo.; St. Louis University School of Dentistry, 1898; died December 26; aged 69.

Neil, E. L., Gillette, Wyo.; Kansas City Dental College, 1919; died of pneumonia, December 27; aged 39. Dr. Neil was president of the Wyoming State Board of Dental Examiners at the time of his death. The widow and one son survive.

Nones, Robert Hodgson, Philadelphia, Pa.; School of Dentistry, Temple University, 1885; died December 28.

Saville, Guy P., Joliet, Ill.; University of Michigan, School of Dentistry, 1902; died December 6; aged 58.

Torrey, George W., Chicago, Ill.; Chicago College of Dental Surgery, 1899; died December 12; aged 65.

Williams, Elizabeth Conroy, Langley Field, Va.; Washington University School of Dentistry, 1925; died of pneumonia, December 31, ten days after the death of her father, John Keane Conroy. Dr. Williams was 34 years old.

Weinzierl, E. L., Oshkosh, Wis.; Marquette University Dental School, 1924; died recently.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J., July 12-16.

American Academy of Periodontology, Atlantic City, N. J., July 8-10.

American Academy of Restorative Dentistry, Atlantic City, N. J., July 10-11.

American Association of Dental Schools, Baltimore, Md., March 15-17.

American Board of Orthodontia, Chicago, Ill., April 17.

American Dental Society of Europe, Paris, France, August 2-5.

American Society of Oral Surgeons and Exodontists, Atlantic City, N. J., July 9-10.

American Society of Orthodontists, Chicago, Ill., April 19-22.

Association of American Women Dentists, Atlantic City, N. J., July 12-16.

Academy of Anesthesiology in Oral Surgery, New York City, March 24.

International Association for Dental Research, Baltimore, Md., March 13-14.

International Dental Federation, Stockholm, Sweden, July 9-14, 1937.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Central Pennsylvania Seventh District Dental Society, Altoona, March 2-3.

Eastern Association of Graduates of Angle School of Orthodontia, Cleveland, Ohio, March 15-16.

Five State Post Graduate Clinic, Washington, D. C., March 7-10.

New York Society of Dental History and Culture, New York City, April 14.

St. Louis (Mo.) Dental Alumni Association Annual Reunion, March 31-April 1.

Thomas P. Hinman Midwinter Clinic, Atlanta, Ga., March 15-16.

University of Louisville Centennial, Louisville, April 5-7.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

Cleveland (Ohio) Dental Society, May 3-4.

American Dental Assistants Association, Atlantic City, N. J., July 12-16.

Ontario (Canada) Dental Association, Toronto, May 17-19.

Australian Dental Congress, Sydney, August 16-20.

American Dental Hygienists Association, Atlantic City, N. J., July 12-16.

STATE SOCIETIES

March

District of Columbia, at Washington (7-10)

April

Alabama, at Mobile (12-14)
Arizona, at Phoenix (23-24)
California, at San Jose (12-14)
Kentucky, at Louisville (5-7)
Louisiana, at New Orleans (8-10)
Massachusetts, at Boston (26)
Michigan, at Detroit (26-28)
Mississippi, at Jackson (5-7)
New Jersey, at Atlantic City (24)
Oklahoma, at Tulsa (4-7)
Wisconsin, at Milwaukee (19-22)

May

Arkansas, at Little Rock (10-12)
Connecticut, at Hartford (12-14)
Georgia, at Savannah (17-19)
Illinois, at Springfield (11-13)
Indiana, at Indianapolis (17-19)
Iowa, at Des Moines (4-6)
Kentucky, at Louisville (5-7)
Maryland, at Baltimore (3-5)
Missouri-Kansas, at Kansas City, Mo. (16-19)
Montana, at Anaconda (6-8)
Nebraska, at Omaha (17-19)
New York, at New York City (4-7)
North Carolina, at Pinehurst (3-5)
North Dakota, at Fargo
Pennsylvania, at Pittsburgh (4-6)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

South Dakota, at Mitchell (10-11)
Tennessee, at Knoxville (10-13)
Texas, at Houston (17-20)
Virginia, at Virginia Beach (10-12)
Washington, at Bellingham (3-5)
West Virginia, at Bluefield (17-19)

June

Colorado, at Colorado Springs (10-12)
Idaho, at Boise
Maine at Rangeley (25-26)
Nevada, at Reno (5)
New Hampshire, at North Conway (21-22)
New Mexico, at Albuquerque
Panama, at Colon (12)
South Carolina, at Columbia (14-15)
Utah, at Logan (10-12)
Wyoming, at Casper (21-22)

September

Southern California, at Los Angeles (13-15)

November

Florida, at Hollywood (4-6)
Ohio, at Columbus (8-10)
Puerto Rico, at San Juan

December

Hawaii, at Honolulu

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 21. James A. Blue, 1016 Comer Bldg., Birmingham, Secretary.

California, at San Francisco, May 24, and at Los Angeles, June 21. Kenneth I. Nesbitt, State Bldg., San Francisco, Secretary.

Florida, at Jacksonville, June 21. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Indiana, at Indianapolis, June 15. J. M. Hale, Mt. Vernon, Secretary.

Kentucky, June 15-18. Robert L. Sprau, 970 Baxter Ave., Louisville, Secretary.

Maine, at Augusta, June 28-30. Fred B. Wheaton, 319 Main St., Biddeford, Secretary.

Minnesota, at Minneapolis, June 18-24. Paul Hagen, Crookston, Secretary.

New Jersey, June 28-July 2. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

Ohio, at Columbus, June 28. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

South Carolina, at Columbia, June 10-12. T. C. Sparks, Medical Bldg., Columbia, Secretary.

Dental Corps, U. S. Army, June 14-19, Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas. Adjutant General, U. S. Army, Washington, D. C.

ARIZONA STATE DENTAL SOCIETY

The next meeting of the Arizona State Dental Society will be held in Phoenix, April 23-24.

PAUL K. HILL, *Secretary,*
Tucson,
Consolidated Bank Bldg.

CONNECTICUT STATE DENTAL SOCIETY

(Change of Dates)

The next meeting of the Connecticut State Dental Society will be held in Hartford, May 12-14.

C. W. VIVIAN, *Secretary,*
58 Elbridge Road,
New Britain.

KENTUCKY STATE DENTAL ASSOCIATION AND UNIVERSITY OF LOUISVILLE CENTENNIAL

The Kentucky State Dental Association and the University of Louisville will cooperate in putting on a joint university alumni and state association meeting, April 5-7. The meeting will be in part one of the activities held in connection with the University of Louisville Centennial celebration.

J. T. O'ROURKE, *Dean,*
University of Louisville,
Louisville.

DENTAL SOCIETY OF THE STATE OF NEW YORK

The sixty-ninth annual meeting of the Dental Society of the State of New York will be held in New York City at the Hotel Waldorf-Astoria, May 4-7.

PENNSYLVANIA STATE DENTAL SOCIETY

The annual meeting of the Pennsylvania

State Dental Society will be held at the William Penn Hotel, Pittsburgh, May 4-6.

W. EARLE CRAIG, *Program Chairman.*

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The South Carolina State Dental Association will hold its annual meeting at the Jefferson Hotel in Columbia, June 14-15.

T. C. SPARKS, *Secretary,*
Medical Bldg.,
Columbia.

BOARD OF DENTAL EXAMINERS OF ALABAMA

The Board of Dental Examiners of Alabama will conduct its next annual dental examinations in Birmingham, commencing at 8:30 a. m., June 21. All credentials must be in the office of the secretary at least two weeks before the date of commencement of examinations. Address all requests for further information to

JAMES A. BLUE, *Secretary,*
1016 Comer Bldg.,
Birmingham.

STATE BOARD OF DENTAL EXAMINERS OF CALIFORNIA

The next examination to be conducted by the Board of Dental Examiners of California for license to practice dentistry and for license to practice dental hygiene in California will be held in San Francisco commencing May 24, at the College of Physicians and Surgeons of San Francisco, A School of Dentistry, and in Los Angeles, Room 804 City Hall, commencing June 21. All credentials must be in the office of the secretary at least twenty days prior to the examinations. Address all communications to

KENNETH I. NESBITT, *Secretary,*
State Building Annex,
San Francisco.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The next examination for licensure of the Indiana State Board of Dental Examiners will be held in Indianapolis beginning June 15. All applications, fees and credentials must be in the hands of the secretary not later than ten days before the beginning date of the examinations. For applications, instructions to candidates and other information, address

J. M. HALE, *Secretary,*
Mt. Vernon.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The examination for license to practice dentistry in Kentucky will be held by the Kentucky State Board of Dental Examiners, June 15-18.

ROBERT L. SPRAU, *Secretary,*
970 Baxter Ave.,
Louisville.

STATE OF MAINE BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Maine Board of Dental Examiners will be held in Augusta, June 28-30, for dentists and hygienists. All applications must be on file ten days before examinations. For applications and information, address

FRED B. WHEATON, *Secretary,*
319 Main St.,
Biddeford.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, June 18-24. All applications must be in the hands of the secretary at least ten days before the opening date. Address all communications to

PAUL HAGEN, *Secretary,*
Crookston.

OHIO STATE DENTAL BOARD

The June examination of the Ohio State Dental Board will be held at the College of Dentistry, Ohio State University, Columbus, the week beginning June 28. All applications must be in the hands of the secretary at least ten days before date of the examination. For further information, apply to

MORTON H. JONES, *Secretary,*
1553½ North Fourth St.,
Columbus.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The South Carolina State Board of Dental Examiners will hold its next examination in Columbia, June 10-12. All applications must be in thirty days before the examination starts.

T. C. SPARKS, *Secretary,*
Medical Bldg.,
Columbia.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The sixteenth annual meeting of the Association of American Women Dentists, to be held at Atlantic City, N. J., July 12-16, will be opened by a breakfast at 8:30 a. m., July 12. A banquet will be held that night at 7:30. Notice of meeting places will be given later.

E. PEARLE BISHOP, *Chairman,*
Publicity Committee,
316 Republic Bldg.,
Denver.

AMERICAN ACADEMY OF PERIODONTOLOGY

The twenty-fourth annual meeting of the American Academy of Periodontology will be held at the Claridge Hotel, Atlantic City, July 8-10. Members of the A.D.A. who are interested in periodontia are invited to attend.

RAYMOND E. JOHNSON, *Secretary,*
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet July 10-11 at the Hotel Traymore, Atlantic City, N. J.

A. F. SCHOPPER, *Secretary,*
Professional Bldg.,
Kansas City, Mo.

ACADEMY OF ANESTHESIOLOGY IN ORAL SURGERY

The Academy of Anesthesiology in Oral Surgery will meet March 24 at the George Washington Hotel, New York City. Those desiring to attend the lecture communicate with

J. M. ESKOW, *Secretary,*
147 Market St.,
Perth Amboy, N. J.

NEW YORK SOCIETY OF DENTAL HISTORY AND CULTURE

The New York Society of Dental History and Culture will hold its next meeting Wednesday evening, April 14, in the auditorium of the Squibb Bldg., New York City. Members of the dental and medical professions are invited.

WALTER H. JACOBS, *Secretary,*
124 West Ninety-Third St.,
New York City.

THOMAS P. HINMAN MIDWINTER CLINIC

The twenty-third annual session of the Thomas P. Hinman Midwinter Clinic will be held at the Biltmore Hotel, Atlanta, March 15-16.

J. D. OSBORNE, *Secretary,*
Doctors Bldg.,
Atlanta, Ga.

CLEVELAND DENTAL SOCIETY

The Cleveland Dental Society will hold its sixth annual two day clinic, May 3-4.

OSCAR R. ROSEN, *Chairman,*
Publicity,
562 Rose Bldg.,
Cleveland, Ohio.

UNIVERSITY OF BUFFALO DENTAL ALUMNI ASSOCIATION OF GREATER NEW YORK

The University of Buffalo Dental Alumni Association of Greater New York will hold its annual stag dinner March 13 at the Hotel Pennsylvania, New York City.

MORGAN S. SMITH, *Secretary,*
48 Rockaway Turnpike,
Lawrence, N. Y.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, U. S. ARMY

The War Department is announcing an examination during the week of June 14-19 to qualify candidates for appointment as first lieutenants in the Dental Corps, Regular Army. Examining boards will be convened at Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas. A circular of information concerning the Army Dental Corps may be secured by writing to the Adjutant General, United States Army, Washington, D. C. Applications for permission to take the examination

should be addressed to the Adjutant General, U. S. Army, Washington, D. C. In order to be eligible to take this examination, the applicant must be a citizen of the United States; a graduate of a recognized dental school; in good standing in his profession; between the ages of 22½ and 31¾ years at the time of examination, and must have been in the practice of his profession for one year and eleven months subsequent to graduation. The examinations will consist of a physical examination, a professional examination in three parts (written, oral and clinical) and a determination of the candidate's adaptability for military service. Applications for this examination will not be considered if received after June 1.

ANNOUNCEMENT OF THE LORD AND CHAIM PRIZES FOR 1937

The First District Dental Society of the State of New York invites the preparation and submission of essays to compete for the Lord and Chaim Prizes.

Annually, at the discretion of the Board of Directors, these awards may be made from funds made available for that purpose through the beneficence of the late Morris L. Chaim and Benjamin Lord, according to the following conditions.

1. The Morris L. Chaim Prize of $250 is offered for a meritorious essay not previously published on research in dentistry or any of its specialties. The essay may also deal with the fundamental sciences provided the work has a definite bearing on some dental problem.

2. The Benjamin Lord Prize of $150 is offered for a meritorious essay not previously published, on the practical or clinical phases of dentistry.

Conditions Governing Competitors

1. Eligibility: Members in good standing of any recognized dental, medical or scientific society in the United States or other countries; or duly registered students of a recognized educational or scientific institution.

2. Date: Papers are to be submitted on or prior to June 1, 1937 or June 1 of any succeeding year, to the Secretary of the First District Dental Society, 2 E. 103rd St., New York City.

3. Manuscripts: They shall be typewritten double spaced, and accompanied by all necessary photographs, drawings, diagrams, tables, and bibliography and shall be ready for publication. All manuscripts submitted shall be in English.

4. Identification: The manuscripts and all drawings, diagrams, photographs, tables, bibliography, data, etc., shall be in a plain wrapper or envelop which shall bear on the outside some symbol, group of letters, figures or other identification mark, and accompanying each such sealed packet or envelop, another sealed envelop having on the outside a duplicate of such symbol, group of letters, figures or other mark, and within this sealed envelop shall be the name and address of the person submitting the manuscript, also the names of societies of which the competitor is a member. There should be nothing in the essay which will identify the person submitting it.

5. Publication: Essays receiving the awards may be published after announcement of the awards in any reputable journal in the United States at the discretion of the author, together with simultaneous publication by the First District Dental Society of the State of New York, if it so desires. Wherever and whenever published, the papers awarded the prizes shall be accompanied by this statement: "Awarded the Morris L. Chaim or the Benjamin Lord Prize (as the case may be) by the First District Dental Society of the State of New York for the year ——."

6. Disposition: Essays submitted, but not awarded prizes, will be returned to the authors.

Further information may be obtained by addressing: E. M. Davies, Executive Secretary, First District Dental Society, Academy of Medicine, 2 East 103rd St., New York City.

ONTARIO DENTAL ASSOCIATION

The seventieth annual convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, May 17-

19. Dentists from the United States and from parts of Canada outside Ontario will be welcomed as guests.

FRED J. CONBOY, *Secretary,*
86 Bloor St. West,
Toronto, Canada.

AMERICAN DENTAL HYGIENISTS ASSOCIATION

The annual meeting of the American Dental Hygienists Association will be held at Atlantic City, July 12-16.

DAISY M. BELL, *Secretary,*
974 Amherst St.,
Buffalo, N. Y.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY

1936

November 3

2,059,262 Frederick S. Meyer: Method for preparing dental restoratives.

2,059,330 Addison H. Flournoy: Rotating toothbrush.

2,059,391 Fred Peddie, Wallace Clemens Bentley and Saul N. Israel: Tooth paste dispensing device.

2,059,396 Jean Ripert: Dentifrice product.

2,059,928 Reuben Berk: Dental flask.

November 10

2,060,478 Luis M. Valbuena: Artificial tooth.

2,060,555 Lucian G. Goble: Dental instrument.

November 17

2,060,869 Joseph A. Hopkins: Demonstration device.

2,061,430 Robert E. Ley. Toothbrush & powder container.

2,061,484 Leslie Norman Roebuck: Apparatus for use in the formation of artificial dentures.

November 24

2,061,544 Max Bockmuhl and Willy Ludwig: Aqueous solution of anesthetic substances.

2,061,550 Benjamin A. Cavazza: Mouthplece.

2,061,557 Max Bockmuhl, Otto Schaumann, Gustav Ehrhart and Leonhard Stein: Anesthetic combinations containing, besides a local anesthetic agent, a vasoconstricting agent.

2,061,936 Charles Engelfried: Mouth prop.

Des. 102,048 Edwin I. Brothers and Abe R. Brothers: Design for a prophylactic device for the oral cavity.

Des. 102,055 Nicholas Kirsten: Design for a brush.

December 1

2,062,395 Archie B. Brusse and Joseph L. Carmen: Orthodontic appliance.

2,062,592 Adam J. May: Headrest supporting means.

December 8

2,063,122 Stanley Henry Richardson: Attachment for hydraulically operated dental chairs and the like.

2,063,667 Ladislaus Farkas and Paul Harteck: Filling cavities.

December 15

2,064,176 Morgan Parker: Detachable blade knife.

December 22

2,065,186 Alfred Keil: Heater casing for use with a dental press.

December 29

2,066,204 Alois Kaltenbach and Richard Voigt: Guide-pulley bearing for band drive in dental machines.

1937

January 5

2,066,313 Roy E. Barr: Dental instrument.

January 12

Re: 20,234 Harry Chester Berry: False teeth:

January 19

2,067,889 Albert B. Collingbourne: Dental floss applicator.

2,068,177 Walter R. Henion: Anesthetizing apparatus.

2,068,571 Irving E. Rotner: Cover for headrests.

January 26

2,068,927 Mendel Nevin: Hypodermic syringe.

2,069,112 Sally Oppenheim: Device for treating tooth-root membrane.

2,069,157 Melville Sahyun: Dental preparation.

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

December 31, 1936

Alabama	324
Arizona	77
Arkansas	171
Army	153
California	1,758
Colorado	475
Connecticut	776
Delaware	57
District of Columbia	385
Florida	427
Foreign	20
Georgia	463
Idaho	130
Illinois	3,519
Indiana	979
Iowa	1,052
Hawaii	84
Kansas	481
Kentucky	450
Louisiana	327
Maine	199
Maryland	372
Massachusetts	1,559
Michigan	1,656
Minnesota	1,493
Mississippi	191
Missouri	1,123
Montana	169
Nebraska	498
Nevada	32
New Hampshire	145
New Jersey	1,755
New Mexico	74
New York	4,283
North Carolina	470
North Dakota	165
Navy	127
Ohio	2,199
Oklahoma	431
Oregon	448
Pennsylvania	3,285
Philippine Islands	5
Puerto Rico	90
Rhode Island	169
South Carolina	147
South Dakota	175
Southern California	1,449
Tennessee	537
Texas	1,016
Utah	223
Vermont	90
Virginia	434
Washington	719
West Virginia	353
Wisconsin	1,313
Wyoming	62
U. S. Public Health Service	97
U. S. Veterans Administration	99
Panama Canal Zone	20
Total Regular Members	39,780

JUNIOR MEMBERSHIP

Following is the Junior Membership of the American Dental Association by colleges as of Jan. 31, 1937.

Atlanta Southern Dental College	21
Baylor University	54
Chicago College of Dental Surgery	150
College of Physicians and Surgeons	92
Columbia University	36
Creighton University	9
Georgetown University	74
Indiana University	101
Kansas City-Western Dental College	31
Loyola University	96
Marquette University	94
Medical College of Virginia	29
New York University	35
North Pacific College of Oregon	31
Northwestern University	31
Ohio State University	28
State University of Iowa	74
Temple University	167
Texas Dental College	48
Tufts College	4
University of California	22
University of Buffalo	38
University of Detroit	53
University of Illinois	19
University of Louisville	6
University of Maryland	80
University of Michigan	53
University of Minnesota	44
University of Nebraska	7
University of Pennsylvania	5
University of Pittsburgh	1
University of Southern California	138
University of Tennessee	7
Washington University	3
Western Reserve University	82
Total Junior Members	1,763

AMERICAN DENTAL ASSOCIATION 1936 MEMBERSHIP RECORD

The following percentages have been obtained on quotas for constituent societies on the basis of a total membership of 45,000.

Alabama	79.80%	New Hampshire	99.32
Arizona	81.92	New Jersey	117.14
Arkansas	70.50	New Mexico	117.43
Army	95.63	New York	72.65
California	92.80	North Carolina	96.53
Colorado	101.25	North Dakota	84.62
Connecticut	129.12	Navy	125.74
Delaware	89.06	Ohio	89.45
District of Columbia	118.10	Oklahoma	85.04
Florida	98.61	Oregon	80.43
Foreign	142.86	Pennsylvania	88.46
Georgia	80.10	Philippine Islands	500.00
Idaho	85.52	Puerto Rico	225.00
Illinois	93.77	Rhode Island	70.43
Indiana	82.77	South Carolina	60.00
Iowa	97.77	South Dakota	80.28
Hawaii	85.71	Southern California	92.80
Kansas	72.36	Tennessee	103.87
Kentucky	83.02	Texas	81.22
Louisiana	69.33	Utah	108.78
Maine	74.81	Vermont	92.78
Maryland	71.48	Virginia	88.06
Massachusetts	71.88	Washington	83.70
Michigan	105.47	West Virginia	83.26
Minnesota	120.89	Wisconsin	97.13
Mississippi	69.96	Wyoming	91.18
Missouri	72.31	U. S. Public Health Service	116.87
Montana	93.44	U. S. Veterans Administration	111.36
Nebraska	80.32	Panama Canal Zone	285.71
Nevada	78.05		

AMERICAN DENTAL ASSOCIATION

Atlantic City, New Jersey **July 12-16, 1937**

HOTEL RESERVATIONS

To secure hotel accommodations for the 1937 Session, consult the rate list below and fill out the attached blank. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 120, Hotel Ambassador, Atlantic City, N. J. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel releasing the room, in order that it may be available for other members.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION

Atlantic City, N. J. July 12-16, 1937

HOTEL.....1st Choice

HOTEL.....2nd Choice

HOTEL.....3rd Choice

Kindly reserve the following:

.....Rooms with Bath for.....persons $.....per Room

.....Rooms without Bath for.....persons $.....per Room

Arriving on July.....at.....A. M.....P. M.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL
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NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make the reservation requested, this application should be forwarded at once to the Housing Committee, Room 120, Ambassador Hotel, Atlantic City, N. J.

BOARDWALK HOTELS	WITH BATH*		Additional Charge for Each Person for Three Meals
	One Person	Two Persons	
AMBASSADOR Boardwalk at Brighton Ave.	$3.00–4.00–5.00–6.00	$6.00–7.00–8.00–10.00	$4.00
BRIGHTON Boardwalk at Indiana Ave.	3.00–4.00–5.00	5.00–6.00–7.00–8.00	3.50
CHALFONTE-HADDON HALL Boardwalk at North Carolina Ave.	3.00–4.00–6.00–8.00	6.00–8.00–10.00–12.00	3.50
CHELSEA Boardwalk at Morris Ave.	3.00–4.00–5.00	5.00–6.00–7.00–8.00	3.00
CLARIDGE Boardwalk at Park Place	4.00–5.00–6.00	6.00–7.00–8.00–11.00	4.00
DENNIS Boardwalk at Michigan Ave.	3.50–4.00–5.00–6.00	6.00–7.00–8.00–9.00–10.00	3.00
KNICKERBOCKER Boardwalk at Tennessee Ave.	3.00–3.50–4.00	5.00–6.00–7.00–8.00–9.00	3.00
MARLBOROUGH-BLENHEIM Boardwalk at Ohio Ave.	4.00–5.00–6.00	6.00–7.00–8.00–10.00–11.00	3.00
NEW BELMONT Boardwalk at Ocean Ave.	2.50–3.00	4.00–5.00–6.00–8.00	†
RITZ-CARLTON Boardwalk at Iowa Ave.	4.00–5.00	6.00–7.00–8.00	3.00
STRAND Boardwalk at Pennsylvania Ave.	3.50	6.00–7.00–9.00	3.00
SEASIDE Boardwalk at Pennsylvania Ave.		6.00–7.00–8.00	3.00
SHELBURNE Boardwalk at Michigan Ave.	4.00–5.00	6.00–7.00–8.00	E. P. Only
TRAYMORE Boardwalk at Illinois Ave.	3.50–4.00–5.00	6.00–7.00–8.00	3.00

*Rates on single and double rooms with running water available on request.
†European plan only.

AVENUE HOTELS	WITH BATH*		Additional Charge for Each Person for Three Meals
	One Person	Two Persons	
ARLINGTON 116 S. Michigan Ave.		9.00—American plan only	2.00
COLTON MANOR 110 S. Pennsylvania Ave.	3.00–3.50–4.00	5.00–6.00–7.00	2.00
FLANDERS 127 St. James Place	2.50–3.00–4.00	4.00–5.00–6.00	2.00
FRANKLIN INN 157 S. Virginia Ave.	3.00	4.00–5.00	2.00
GLASLYN-CHATHAM Park Place	Rooms with running water only		2.00
JEFFERSON 136 S. Kentucky Ave.	3.00–3.50	5.00–5.50–6.00	2.50
KENTUCKY 126 S. Kentucky Ave.	Rooms with running water only		†
LAFAYETTE 109 S. North Carolina Ave.	3.00–3.50–4.00	5.00–6.00–7.00	2.00
MADISON 123 S. Illinois Ave.	3.00–3.50–4.00	5.00–6.00–7.00	2.50
MONTICELLO 131 S. Kentucky Ave.	Rooms with running water only		2.00
MORTON 150 S. Virginia Ave.	4.50	7.00	2.50
PRINCESS 144 S. South Carolina Ave.	4.00	5.50–7.00	2.00
SENATOR 166 S. South Carolina Ave.		7.00	2.50
STERLING 144 S. Kentucky Ave.		5.00	2.00
THURBER Atlantic and Massachusetts Ave.	Rooms with running water only		†

*Rates on single and double rooms with running water available on request.
†European plan only.

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1936-1937

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